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The SFB 732 brings together scientists from the areas of linguistics, computational linguistics and signal processing at the University of Stuttgart. Their common scientific goals are to achieve a better understanding of the mechanisms that lead to ambiguity control/disambiguation as well as the enrichment of missing/incomplete information and to develop methods that are able to fully describe these mechanisms.

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Preface

The 13th installment of the annual meeting of the Gesellschaft für Semantik, Sinn und Bedeutung 13, took place September 30—October 2, 2008 at the University of Stuttgart. Our invited speakers were Gerhard Jäger, Lauri Karttunen, Alex Lascarides, and Claudia Maienborn. In addition, 42 submitted abstracts were selected for presentation. We are delighted to be able to include 38 of these in the proceedings.

On behalf of the organizers – Ljudmila Geist, Klaus von Heusinger, Hans Kamp, Udo Klein, Fabienne Martin, Edgar Onea, Arndt Riester, and Torgrim Solstad – we would like to thank the speakers, reviewers and student helpers for making SuB13 such an inspiring and enjoyable event. We are also much obliged to Nina Seemann for assisting us with the typesetting of this document.

The financial support of the Deutsche Forschungsgemeinschaft and the Collaborative Research Center 732 Incremental Specification in Context is gratefully acknowledged.

Stuttgart, May 20, 2009
Arndt Riester
Torgrim Solstad
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Pragmatic Rationalizability

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Abstract

We present a formal game-theoretic model towards the explanation of implicatures based on the computation of iterated best responses: literal meaning of signals constitutes their default interpretation, and rational communicators decide about their communicative strategies by iteratively calculating the best response to this default strategy. We demonstrate by means of several examples how the resulting pragmatically rationalizable strategies account for different types of implicatures.

1 Signaling Games

In order to introduce the basic concepts of the underlying game-theoretic model (see e.g. Osborne and Rubinstein, 1994, for an introductory textbook on game theory), let us look at a simple scenario where communication makes a decisive difference. Suppose Robin invited Sally for dinner where he wants to serve some thai curry. While slicing the chili he realizes that he is unsure about whether Sally likes her curry hot or not. Robin obviously wants to offer his guest the curry in her preferred way. In other words, they both prefer the outcome where Sally receives her favorite type of curry over the other outcome, where she finds it inedible because of the lack or the abundance of chili.

We may formalize this scenario as follows. There are two possible worlds, \( w_1 \) and \( w_2 \). In \( w_1 \) Sally prefers mild curry; in \( w_2 \) she likes it hot. Robin has a choice between two actions: preparing a mild curry would be action \( a_{\text{mild}} \), and preparing a hot curry action \( a_{\text{hot}} \). Sally knows how she likes her curry, i.e. she knows which world they are in, but poor Robin does not. But although he does not know for sure, he may have some \textit{a priori} belief about Sally’s liking, i.e. about the probabilities of each world. Maybe Robin has seen her eat jalapeño spiced taco burgers on another occasion such that he assumes \( w_2 \) to be more likely than \( w_1 \). In our concrete example, let us assume that he is totally clueless – he assigns both worlds an \textit{a priori} probability of 50%.

This scenario can be represented formally as follows. In game theory, the preferences are usually encoded by assigning numerical values, called \textit{utilities} or \textit{payoffs}, to each outcome for each player. For instance, as Robin prefers the outcome of performing action \( a_{\text{mild}} \) in world \( w_1 \) over the outcome of performing the same action in \( w_2 \), we may
Gerhard Jäger and Christian Ebert

assign 1 to the first and 0 to the second outcome and use the $\geq$-order on natural numbers to reflect the preference order. Continuing like that we arrive at the following utility matrix. Rows represent possible worlds and columns represent Robin’s actions. The first number in each cell gives Sally’s payoff for this configuration, and the second number Robin’s payoff.

\[
\begin{array}{cc}
     & a_{\text{mild}} & a_{\text{hot}} \\
 w_1 & 1,1 & 0,0 \\
 w_2 & 0,0 & 1,1
\end{array}
\]  

(1)

Without any further coordination between the players, Robin will remain clueless and he will have to prepare one type of curry hoping to guess the right one. His expected utility/payoff for performing action $a$ is as follows (given his prior belief $p^*$, the set of possible worlds $W$ and his utilities $u_R(w,a)$ for the outcome $(w,a)$):

\[
EU(a) = \sum_{w \in W} p^*(w) \cdot u_R(w,a)
\]  

(2)

In the case at hand he receives an expected payoff of 0.5 for either action, and (because of their identical preferences/utilities) Sally will also receive an expected payoff of 0.5. They can do better though if they communicate. Sally might simply tell Robin her favourite type of curry. Suppose Robin expects that Sally says “mild” in $w_1$ and “hot” in $w_2$. Then the rational course of action for Robin is to perform $a_{\text{mild}}$ if he hears “mild”, and to perform $a_{\text{hot}}$ upon hearing “hot”. In other words, Robin learns the actual world from Sally’s utterance, i.e. revises his belief, and acts accordingly. On the other hand, if Sally believes that Robin will react to these signals in this way, it is rational for her to say “mild” in $w_1$ and “hot” in $w_2$. If they follow this rational course of behaviour they both will obtain an overall payoff of 1.

So adding the option for communication may improve the payoff of both players. Technically, the original scenario (which is not really a game but a decision problem because Sally has no choice between actions) is transformed into a signaling game. Here the sender (Sally in the example) can send signals, and she can make her choice of signal dependent on the actual world. Formally, the sender’s behaviour is given by a sender strategy, which is a function from possible worlds to signals. The receiver (Robin in the example) can condition his action on the signal received. So a receiver strategy is a function from signals to actions. We will represent strategies graphically as tables indicating the corresponding functions:

\[
\begin{array}{c}
\text{Sally’s strategy } s : \\
\begin{array}{c}
 w_1 \rightarrow \text{“mild”} \\
 w_2 \rightarrow \text{“hot”}
\end{array}
\end{array}
\quad
\begin{array}{c}
\text{Robin’s strategy } r : \\
\begin{array}{c}
 \text{“mild”} \rightarrow a_{\text{mild}} \\
 \text{“hot”} \rightarrow a_{\text{hot}}
\end{array}
\end{array}
\]  

(3)

The above example suggests that rational players will benefit from the option of communication. Things are not that simple though. Consider the following pair of strategies:

\[
\begin{array}{c}
\text{Sally’s strategy } s’ : \\
\begin{array}{c}
 w_1 \rightarrow \text{“hot”} \\
 w_2 \rightarrow \text{“mild”}
\end{array}
\end{array}
\quad
\begin{array}{c}
\text{Robin’s strategy } r’ : \\
\begin{array}{c}
 \text{“hot”} \rightarrow a_{\text{mild}} \\
 \text{“mild”} \rightarrow a_{\text{hot}}
\end{array}
\end{array}
\]  

(4)
If Sally and Robin play these strategies they will also end up with the maximal payoff of 1. Pure reason does not provide a clue to decide between these two ways to coordinate. It is thus consistent with rationality that Sally assumes Robin to use \( r' \) and thus to signal according to \( s' \), while Robin assumes Sally to use \( s \), and thus will interpret her signals according to \( r \). In this situation, Robin will perform \( a_{\text{hot}} \) in \( w_1 \) and \( a_{\text{mild}} \) in \( w_2 \). Both players would receive the worst possible expected payoff of 0 here.

These considerations ignore the fact that the two signals have a conventional meaning which is known to both players. In our example, we would say that the conventional meaning of “mild” is the proposition \([\text{mild}] = \{w_1\}\) whereas the meaning of “hot” is \([\text{hot}] = \{w_2\}\). Then \((s,r)\) is a priori more plausible than \((s',r')\) because in \((s,r)\) Sally always says the truth and Robin always believes the literal meaning of Sally’s message.

However, rational players cannot always rely on the honesty/credulity of the other player. Consider the following scenario. Rasmus also invites Sally for dinner but he cannot stand her. He wants to annoy her by preparing the curry the way she does not like. So while Sally will still prefer to receive her favoured type of curry, Rasmus will be happy only if he manages to prepare her disfavoured type.

Here the interests of Sally and Rasmus are strictly opposed; everybody can only win as much as the other one looses. Again we assume that Sally can send two signals “mild” and “hot” with the conventional meaning as above. If Rasmus is credulous, he will react to “mild” with \( a_{\text{hot}} \) and to “hot” with \( a_{\text{mild}} \). But if Sally believes this and is rational, she will be dishonest and send “hot” in \( w_1 \) (where she actually likes mild curries) and “mild” in \( w_2 \) (where she actually likes hot curries). But Rasmus might anticipate this. If he is not quite so credulous, he may switch his strategy accordingly, and react to “mild” with \( a_{\text{mild}} \) etc. This again might be anticipated by Sally and she might revert to the lying strategy, which again might be anticipated by Rasmus, etc. In fact, it turns out that any strategy is rationalizable in this game.\(^1\) In other words, no real communication ensues. The lesson here is that communication might help in situations where the interests of the players are aligned, but it does not make a difference if these interests are completely opposed.

### Gricean Reasoning

The kind of reasoning that was informally employed in the last section is reminiscent to pragmatic reasoning in the tradition of Grice (1975). For instance, information can only be exchanged between rational agents if it is in the good interest of both agents that this information transfer takes place. This intuition is captured by Grice’s Cooperative Principle. Furthermore, we mentioned the default assumption that messages are used

\(^1\)A strategy \( s \) is rationalizable if there is a consistent set of beliefs such that \( s \) maximizes the expected payoff of the player, given these beliefs and the assumption that rationality of all players is common knowledge.
according to their conventional meaning, unless overarching rationality considerations dictate otherwise. This corresponds to Grice’s Maxim of Quality.

To illustrate how game theoretic reasoning can account for pragmatic reasoning let us consider the prime example of a scalar implicature, namely the strengthening of the conventional meaning of “some” to “some but not all”. You can imagine that Robin wants to know who was at the party last night, and Sally knows the answer. In \( w \) all girls were at the party and in \( w_\neg \) some but not all girls were there. Again, Robin is completely unsure, i.e. he considers each world to be equally likely. Considering Robin’s actions let us assume that there are three of them: two actions \( a_\forall \) and \( a_\neg \) that are appropriate in and only in worlds \( w \) and \( w_\neg \), respectively, and a kind of default action \( a_? \). For each world, both Sally and Robin prefer Robin to perform the appropriate action to Robin performing the default action, which they in turn prefer to Robin performing the inappropriate action. The following payoff structure reflects this preference order.

<table>
<thead>
<tr>
<th></th>
<th>( a_\forall )</th>
<th>( a_\neg )</th>
<th>( a_? )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( w )</td>
<td>10, 10</td>
<td>0, 0</td>
<td>9, 9</td>
</tr>
<tr>
<td>( w_\neg )</td>
<td>0, 10</td>
<td>10, 9</td>
<td>9, 9</td>
</tr>
</tbody>
</table>

Furthermore we have three different messages with their corresponding conventional meaning.

\[
\begin{align*}
  f_\forall & = \text{“All girls were at the party.”} & [f_\forall] & = \{w\} \\
  f_\neg & = \text{“Some but not all girls were at the party.”} & [f_\neg] & = \{w_\neg\} \\
  f_? & = \text{“Some girls were at the party.”} & [f_?] & = \{w, w_\neg\}
\end{align*}
\]

Obviously \( f_\neg \) is more complex than the other two messages, which are approximately equally complex. This is covered by the assignment of costs to signals which the sender has to pay. Formally this is implemented by a cost function \( c \) that assigns some numerical value to every signal. Let us say that in this example we have \( c(f_\forall) = c(f_?) = 0 \) and \( c(f_\neg) = 2 \). So the sender’s utility is now a three-place function \( u_S \) that depends on the actual world, the message sent, and the action that the receiver takes. If \( v_S(w, a) \) is the distribution of sender payoffs that is given in the payoff table (6) above, the sender’s overall utility is now

\[
u_S(w, f, a) = v_S(w, a) - c(f)
\]

According to Gricean pragmatics, Sally would reason about her strategy roughly as follows:

If I am in \( w \) I want Robin to perform \( a_\forall \) because this gives me a utility of 10. \( a_\forall \) is what he would do if he believed that he is in \( w \). I can try to convince him of this fact by saying \( f_\forall \). It is not advisable to say \( f_\neg \), because if Robin believed it, he would perform \( a_\neg \), which gives me a utility of a mere –2. Also saying \( f_? \) is not optimal. If Robin believes it, this will not settle the issue which world we are in for him and thus he will perform \( a_? \), because his expected utility in this case is 9 while his expected utility for the other two actions is only 5. This would give me also a utility of 9. So it seems reasonable to send \( f_\forall \) in \( w \).

If I am in \( w_\neg \), it might seem reasonable to say \( f_\neg \) because if Robin believes it, he will perform \( a_\neg \), which is my favorite outcome. However, I will have to pay the
costs of 2, so my net utility is only 8. If I say $f_\exists$ and Robin believes it, he will perform $a_\forall$. Since $f_\exists$ is costless for me, my net utility is 9 in this case, which is better than 8. So in $w_{3\forall}$ I will send $f_\exists$. After this reasoning, Sally will hence settle on the following strategy:

$$
\begin{align*}
  &w_\forall & \rightarrow & f_\forall \text{ ("All girls were at the party.")} \\
  &w_{3\forall} & \rightarrow & f_\exists \text{ ("Some girls were at the party.")}
\end{align*}
$$

Robin in turn will anticipate that Sally will reason this way: If I am confronted with the message $f_\forall$, I know that the world is $w_\forall$, hence I will perform $a_\forall$. If I hear $f_\exists$, I know that the world is $w_{3\forall}$, hence I will perform $a_{3\forall}$ after all. Therefore his strategy will look as follows:

$$
\begin{align*}
  &f_\forall \text{ ("All girls were at the party.")} & \rightarrow & a_\forall \\
  &f_\exists \text{ ("Some girls were at the party.")} & \rightarrow & a_{3\forall}
\end{align*}
$$

Sally, being aware of this fact, will reason: Taking into consideration Robin’s reasoning and his eventual strategy, it is even more beneficial for me to send $f_\exists$ if I am in $w_\exists$ because this will give me the maximal payoff of 10. So I have no reason to change the plan of sending $f_\forall$ in $w_\forall$ and $f_\exists$ in $w_{3\forall}$.

Hence she will stick to her strategy in (8). In a further round of deliberation Robin will realize this and thus also stick to his strategy (9). Any further deliberation of Sally and Robin will not change anything.

This iterated reasoning procedure explains the emergence of the scalar implicature. It leads to a sender strategy where $f_\exists$ is sent if and only if \{w_{3\forall}\} is true. In other words, the literal meaning of $f_\exists$, which is \{w_\forall, w_{3\forall}\}, has been pragmatically strengthened to a proper subset \{w_{3\forall}\}. The information that $w_\forall$ is not the case is a scalar implicature — “some” is pragmatically interpreted as “some but not all”.

As in the examples discussed in the previous section, the inferences that are used here start with a default assumption that messages are used according to their literal interpretation, but this is only a provisional assumption that is adopted if this is not in contradiction with rationality.

## 2 Iterated Best Response

The reasoning pattern that is used here makes implicit use of the notion of the best response of a player to a certain probabilistic belief. A best response (that need not be unique) to such a belief is a strategy that maximizes the expected payoff of the player as compared to all other strategies at his disposal, given this belief state. For a player to be rational means then to always play some best response, given his belief.

Let us now assume the position of an external observer who wants to formally model the notion of a best response, say Sally’s best response to her belief about Robin’s strategies. If we denote the set of strategies available to Robin at some point with $R$, we know that 1. Sally believes that Robin will play some strategy from $R$, 2. Sally holds all strategies in $R$ possible, i.e. she cannot exclude any strategy for sure. Despite that we do not have any further information about Sally’s belief – maybe she holds all strategies in $R$ equally possible, or maybe she considers some strategies more likely than others. The best we can do as external observer is to take all possible beliefs for Sally into account.
Formally we can do this by modeling a belief of Sally as a probability distribution over the set of strategies $R$ such that it does not assign zero probability to any element of $R$ (i.e. Sally cannot exclude any strategy for sure). Let us therefore define the following sets of probability distributions over $X$ for a non-empty and finite set $X$:

$$\Delta(X) \doteq \left\{ p \in X \to [0,1] \mid \sum_{x \in X} p(x) = 1 \right\}$$

(10)

$$\Delta^+(X) \doteq \left\{ p \in X \to (0,1] \mid \sum_{x \in X} p(x) = 1 \right\}$$

(11)

The difference is subtle but important. Both $\Delta(\cdot)$ and $\Delta^+(\cdot)$ can be used to model probabilistic beliefs. If we say that a player holds a belief from $\Delta(X)$, say, this means that he may exclude some elements from $X$ with absolute certainty. On the other hand, if he holds a belief from $\Delta^+(X)$, then he may have certain guesses, but he is not able to exclude any element from $X$ with certainty. In the case discussed above, Sally’s believe about Robin’s strategies $R$ is modeled some $\rho \in \Delta^+(R)$. Hence any best response of Sally’s to any such belief is a potential best response for Sally against $R$. All that we as an external observer can predict with certainty if we assume Sally to be rational, is that she will play some potential best response against $R$.

The iterative inference process that was used in the computation of the implicature above can be informally described as follows. At start, Sally provisionally assumes that Robin is entirely credulous, and that he conditions his actions only on the literal interpretation of the message received. Let us call the set\(^2\) of credulous strategies $R_0$.

**Sally’s turn.** Sally might ponder any strategy that is a potential best response against $R_0$. Let us call this set of strategies $S_0$.

**Robin’s turn.** Robin might ponder all strategies that are potential best responses against $S_0$. The set of these strategies is $R_1$.

**Sally’s turn.** Sally might ponder any strategy that is a potential best response against $R_1$. Let us call this set of strategies $S_1$.

**Robin’s turn** . . .

In general, $S_n$ and $R_{n+1}$ are the set of strategies that are potential best responses against $R_n$ and $S_n$, respectively. If a certain strategy cannot be excluded by this kind of reasoning, i.e. if there are infinitely many indices $i$ such that it occurs in $S_i$ or $R_i$, then we call it a pragmatically rationalizable strategy.

**Contexts**

In the scalar implicature example, the described reasoning of Sally and Robin went in circles at some point. Therefore, all strategies they considered possible at this point were pragmatically rationalizable. These were exactly the strategies in (8) and (9), which described the scalar implicature.

\(^2\)There might be more than one credulous strategy because several actions may yield the same maximal payoff for Robin in certain situations.
Taking another close look at the payoff structure in (6), we see that the scalar implicature arises because the difference between \( v_S(w_{∃¬∀}, a_{∃¬∀}) \) and \( v_S(w_{∃¬∀}, a_{∃¬∀}) \) is smaller than the costs of sending \( f_{∃¬∀} \). Suppose the utilities would be as in (12), rather than as in (6). Then the pragmatically rationalizable outcome would be that Sally uses \( f_{∃¬∀} \) in \( w_{∃¬∀} \), while \( f_{∃¬∀} \) would never be used.

\[
\begin{array}{ccc}
  & a_{∀} & a_{∃¬∀} & a_{∃} \\
 w_{∀} & 10,10 & 0,0 & 6,6 \\
 w_{∃¬∀} & 0,0 & 10,10 & 6,6 \\
\end{array}
\]

At this point, we introduce another level of uncertainty concerning the payoff structure (in addition to the uncertainty of the player about the actual strategy of the other player). Robin might actually not know for sure what Sally’s precise preferences are. If we call the utility matrix (6) context \( c_1 \), and the utilities in (12) context \( c_2 \), Robin might hold some probabilistic belief about whether Sally is in \( c_1 \) or in \( c_2 \). Likewise, Sally need not know for sure which context Robin is in. Now in each round of the iterative reasoning process, the players will ponder each strategy that is a potential best response not only to any probability distribution over strategies of the previous round as before, but also to any probability distribution over contexts. Sally will compute her first set of best responses \( S_0 \) by assuming a credulous Robin as follows: In \( w_{∀} \) I will definitely send \( f_{∀} \), no matter which context is the actual one. Now for \( w_{∃¬∀} \): If the actual context is \( c_1 \) it is better to send \( f_{∃} \) because the costs of sending the more explicit message \( f_{∃¬∀} \) exceed the potential benefits. But if it is \( c_2 \) and it is advisable to use \( f_{∃¬∀} \) nevertheless.

Robin, in turn, will reason as follows to compute his best responses \( R_1 \): If I hear \( f_{∀} \), we are definitely in \( w_{∀} \), and the best thing I can do is to perform \( a_{∀} \), no matter which context we are in. If I hear \( f_{∃¬∀} \) we are in \( c_2/w_{∃¬∀} \) and I will perform \( a_{∃¬∀} \). If I hear \( f_{∃} \) we are in \( c_1/w_{∃¬∀} \) and I will also play \( a_{∃¬∀} \).

So in \( S_1 \) Sally will infer: \( f_{∀} \) will induce \( a_{∀} \), and both \( f_{∃¬∀} \) and \( f_{∃} \) will induce \( a_{∃¬∀} \), no matter which context Robin is in. Since \( f_{∃} \) is less costly than \( f_{∃¬∀} \), I will hence always use \( f_{∀} \) in \( w_{∀} \) and \( f_{∃} \) in \( w_{∃¬∀} \), regardless of the context I am in.

Robin, in \( R_1 \), will thus conclude that his best response to \( f_{∀} \) is always \( a_{∀} \), and his best response to \( f_{∃} \) is \( a_{∃¬∀} \). Nothing will change in later iterations. So here, the scalar implicature from “some” to “some but not all” will arise in all contexts, even though context \( c_2 \) by itself would not license it.

**The Formal Model**

In this section we will present a formal model that captures the intuitive reasoning from the last section. A *semantic game* is a game between two players, the *sender* and the *receiver*. It is characterized by a finite set of contexts \( C \), a finite set of worlds \( W \), a finite set of signals (or forms) \( F \), a finite set of actions \( A \),

- a probability distribution \( p^* \in \Delta^+(W) \) specifying the receiver’s *a priori* probability for each world,
- an interpretation function \( [·]: F \rightarrow \text{Pow}(W) \),
• and utility functions

\[ u_S : C \times W \times F \times A \rightarrow \mathbb{R} \] for the sender and

\[ u_R : C \times W \times A \rightarrow \mathbb{R} \] for the receiver.

As in (7), we will give the sender’s utility function by separating the context/outcome utilities \( v_S \) from the signalling costs \( c : F \rightarrow \mathbb{R} \) in the following. The structure of the game is common knowledge between the players.

**Definition 1.** The space of pure sender strategies \( S = C \times W \rightarrow F \) is the set of functions from context/world pairs to signals. The space of pure receiver strategies \( R = C \times F \rightarrow A \) is the set of functions from context/signals pairs to actions. A sender belief is a pair of probability distributions \( (\rho, p) \in \Delta(R) \times \Delta(C) \) and a receiver belief is a pair of probability distributions \( (\sigma, p) \in \Delta(S) \times \Delta(C) \).

The central step in the iterative process described above is the computation of the set of strategies that maximize the expected payoff of a player against his belief about the strategies of the other player and the context. The notion of a best response captures this.

**Definition 2.** Let \((\sigma, p)\) be a receiver belief and \((\rho, p)\) a sender belief. The set \(BR_R(\sigma, p)\) of best responses of the receiver to \((\sigma, p)\) and the set \(BR_S(\rho, p)\) of best responses of the sender to \((\rho, p)\) are defined as follows:

\[
BR_R(\sigma, p) \doteq \left\{ r \in R \mid \forall c \in C : \arg\max_{r \in R} \sum_{s \in S} \sigma(s) \sum_{c' \in C} p(c') \sum_{w \in W} p^*(w) u_R(c, w, r(c, s(c', w))) \right\}
\]

\[
BR_S(\rho, p) \doteq \left\{ s \in S \mid \forall c \in C : \forall w \in W : \arg\max_{s \in S} \sum_{r \in R} \rho(r) \sum_{c' \in C} p(c') u_S(c, w, s(c, w), r(c', s(c, w))) \right\}
\]

Based on this definition of best responses to a certain belief we may define the set of potential best responses against some set \(P\) of strategies of the opposing player as the set of strategies that are best responses to some belief state that assigns positive probability exactly to the elements of \(P\).

**Definition 3.** Let \(S \subseteq S\) and \(R \subseteq R\) be a set of sender and receiver strategies, respectively. The set \(PBR(S)\) of potential best responses of the receiver to \(S\) and the set \(PBR(R)\) of potential best responses (of the sender) to \(R\) are defined as follows:

\[
PBR(S) \doteq \left\{ r \in BR_R(\sigma, p) \mid (\sigma, p) \text{ a receiver belief with } \sigma \in \Delta^+(S) \right\}
\]

\[
PBR(R) \doteq \left\{ s \in BR_S(\rho, p) \mid (\rho, p) \text{ a sender belief with } \rho \in \Delta^+(R) \right\}
\]

Suppose we know that Sally, being the sender, knows which context and world she is in, she believes for sure that Robin will play a strategy from \(R\), and there is no more specific
information that she believes to know for sure. We do not know which strategy from $R$ Sally expects Robin to play with which likelihood, and which context Sally believes to be in. Under these conditions, all we can predict for sure is that Sally will play some strategy from $\text{PBR}(R)$ if she is rational.

The same seems to hold if we only know that Robin, the receiver, expects Sally to play some strategy from $S$. Then we can infer that Robin, if he is rational, will certainly play a strategy from $\text{PBR}(S)$. However, we may restrict his space of reasonable strategies even further. Suppose none of the strategies in $S$ ever make use of the signal $f$ (formally put, $f \in F - \bigcup_{s \in S} \text{range}(s)$). We call such a signal unexpected. Then it does not make a difference how Robin would react to $f$, but he has to decide about how to react to $f$ nevertheless because receiver strategies are total functions from context/form pairs to actions. It seems reasonable to demand (and it leads to reasonable predictions, as we will see below) that Robin should, in the absence of evidence to the contrary, still assume that $f$ is true. For instance, if Sally speaks English to Robin, and she suddenly throws in a sentence in Latin that Robin happens to understand, Robin will probably assume that the Latin sentence is true, even if he did not expect her to use Latin.

If Robin encounters such an unexpected signal, he will have to revise his beliefs. Robin will have to figure out an explanation why Sally used $f$ despite his expectations to the contrary, and this explanation can bias his prior beliefs in any conceivable way. We have to assume though that the result of this believe revision is a consistent belief state, and that Robin will act rationally according to his new beliefs. Formally speaking, he should only consider strategies that react to an unexpected signal $f$ in a way that maximizes his expected utility, given that $f$ is interpreted literally for some belief about $W$.

We can now proceed to define the iterative reasoning procedure that was informally described in the previous section, taking into account the treatment of unexpected signals detailed above (recall that $p^*$ is the receiver’s a priori probability distribution).

**Definition 4.**

$$ R_0 \doteq \left\{ r \in R \mid \forall c \in C \forall f \in F : r(c, f) \in \text{argmax}_{a \in A} \sum_{w \in [f]} p^*(w)u_R(c, w, a) \right\} $$

$$ S_n \doteq \text{PBR}(R_n) $$

$$ R_{n+1} \doteq \left\{ r \in \text{PBR}(S_n) \mid \forall f \in F - \bigcup_{s \in S_n} \text{range}(s) \forall c \in C : \exists p \in \Delta^+(W) : r(c, f) \in \text{argmax}_{a \in A} \sum_{w \in [f]} p(w)u_R(c, w, a) \right\} $$

$R_0$ is the set of credulous strategies of the receiver. It consists of those strategies $r$ that yield, in each context $c$ and for each signal $f$, some action $a \in A$ that is optimal for the receiver (i.e. that maximize his expected utility, cf. (2)), given that his a priori belief $p^*$ is updated with the information that $f$ is used literally. $S_n$ is the set of potential best responses of the sender against $R_n$. Likewise, $R_{n+1}$ is the set of potential best responses of the receiver if he assumes that the sender plays a strategy from $S_n$ in which he always
tries to make sense of unexpected messages under the assumption that they are literally true.

The sets of \textit{pragmatically rationalizable strategies} are the set of sender strategies and receiver strategies that cannot be excluded for sure by the iterative reasoning process, no matter how deeply the reasoning goes.

**Definition 5.** \((S, R) \in \text{Pow}(S) \times \text{Pow}(R),\) the sets of \textit{pragmatically rationalizable strategies}, are defined as follows:

\[
S \doteq \{ s \in S \mid \forall n \in \mathbb{N} \exists m > n : s \in S_m \}
\]

\[
R \doteq \{ r \in R \mid \forall n \in \mathbb{N} \exists m > n : s \in R_m \}
\]

Note that there are only finitely many strategies in \(S\) and \(R\) (because we are only considering pure strategies over finite sets). Therefore there are only finitely many subsets thereof. The step from \((S_n, R_n)\) to \((S_{n+1}, R_{n+1})\) is always deterministic. It follows that the iterative procedure will enter a cycle at some point. This ensures that \((S, R)\) is always defined.

### 3 Applying the IBR Model

In light of this formal definition, let us consider some of the previous examples again. For the ease of exposition we will specify signals as \(f_{x_1 \ldots x_n}\) with the convention that \([f_{x_1 \ldots x_n}] = \{w_{x_1}, \ldots, w_{x_n}\}.\) Furthermore, if the utilities of the players are identical for each outcome, we will show only one number in the utility matrix. If the \textit{a priori} probability \(p^*\) is not explicitly stated, we assume that it is the uniform distribution on \(W\) that assigns all worlds equal probability.

#### Completely aligned interests

We assume that all signals \(f\) are costless, i.e. \(c(f) = 0.\) There is only one context and \(v_S\) and \(u_R\) are given in table (1). Here is the sequence of iterated computation of potential best responses, starting with the set \(R_0\) of credulous strategies.

\[
R = R_0 = \left\{ \begin{bmatrix} f_1 \rightarrow a_{\text{mild}} \\ f_2 \rightarrow a_{\text{hot}} \\ f_{12} \rightarrow a_{\text{mild}} \end{bmatrix}, \begin{bmatrix} f_1 \rightarrow a_{\text{mild}} \\ f_2 \rightarrow a_{\text{hot}} \\ f_{12} \rightarrow a_{\text{hot}} \end{bmatrix} \right\}
\]

\[
S = S_0 = \left\{ \begin{bmatrix} w_1 \rightarrow f_1 \\ w_2 \rightarrow f_2 \end{bmatrix} \right\}
\]

In the following we will abbreviate the specifications of the strategy sets by dropping the set brackets and by conflating the strategies to one representation. The original set can be recovered by combination of all possible argument/value pairs.

#### Completely Opposing Interests

Again all messages are costless and there is only one context. The utilities are as in (5). Here the iterative procedure enters a never-ending
cycle:

\[
R_0 = \begin{bmatrix}
    f_1 & \rightarrow & a_{\text{hot}} \\
    f_2 & \rightarrow & a_{\text{mild}} \\
    f_{12} & \rightarrow & a_{\text{mild}}/a_{\text{hot}}
\end{bmatrix}
\quad S_0 = \begin{bmatrix}
    w_1 & \rightarrow & f_2 \\
    w_2 & \rightarrow & f_1
\end{bmatrix}
\]

\[
R_1 = \begin{bmatrix}
    f_1 & \rightarrow & a_{\text{mild}} \\
    f_2 & \rightarrow & a_{\text{hot}} \\
    f_{12} & \rightarrow & a_{\text{mild}}/a_{\text{hot}}
\end{bmatrix}
\quad S_1 = \begin{bmatrix}
    w_1 & \rightarrow & f_1 \\
    w_2 & \rightarrow & f_2
\end{bmatrix}
\]

\[
R_2 = R_0 \quad S_2 = S_0
\]

\[
R = [ f_1/f_2/f_{12} \rightarrow a_{\text{mild}}/a_{\text{hot}} ]
\quad S = [ w_1/w_2 \rightarrow f_1/f_2/f_{12} ]
\]

So if the interests of the players are completely opposed, any strategy is pragmatically rationalizable and no communication will ensue.

**Scalar Implicatures and the Q-Heuristics.** Next we will reconsider the example of the scalar implicature discussed above. There are two contexts \( c_1 \) and \( c_2 \) with utilities as in (6) and (12), respectively. The signals and their costs are also as above: \( c(f_1) = c(f_3) = 0 \) and \( c(f_{3\neg\forall}) = 2 \).

\[
R_0 = \begin{bmatrix}
    (c_1,f_1)/(c_2,f_3) & \rightarrow & a_f \\
    (c_1,f_{3\neg\forall})/(c_2,f_{3\neg\forall}) & \rightarrow & a_{3\neg\forall} \\
    (c_1,f_3)/(c_2,f_3) & \rightarrow & a_f
\end{bmatrix}
\quad S_0 = \begin{bmatrix}
    (c_1,w_{3\neg\forall})/(c_2,w_{3\neg\forall}) & \rightarrow & f_f \\
    (c_1,w_{3\neg\forall}) & \rightarrow & f_{3\neg\forall} \\
    (c_2,w_{3\neg\forall}) & \rightarrow & f_3
\end{bmatrix}
\]

\[
R = R_1 = \begin{bmatrix}
    (c_1,f_1)/(c_2,f_3) & \rightarrow & a_f \\
    (c_1,f_{3\neg\forall})/(c_2,f_{3\neg\forall})/(c_1,f_3)/(c_2,f_3) & \rightarrow & a_{3\neg\forall}
\end{bmatrix}
\]

\[
S = S_1 = \begin{bmatrix}
    (c_1,w_{3\neg\forall})/(c_2,w_{3\neg\forall}) & \rightarrow & f_f \\
    (c_1,w_{3\neg\forall})/(c_2,w_{3\neg\forall}) & \rightarrow & f_3
\end{bmatrix}
\]

The previous example illustrated how pragmatic rationalizability formalizes the intuition behind Levinson’s (2000) *Q-heuristics* “What isn’t said, isn’t.” This heuristics accounts, *inter alia* for scalar and clausal implicatures like the following:

1. a. Some boys came in. \( \rightsquigarrow \) Not all boys came in.
   b. Three boys came in. \( \rightsquigarrow \) Exactly three boys came in.

2. a. If John comes, I will leave. \( \rightsquigarrow \) It is open whether John comes.
   b. John tried to reach the summit. \( \rightsquigarrow \) John did not reach the summit.

The essential pattern here is as in the example above: There are two expressions \( A \) and \( B \) of comparable complexity such that the literal meaning of \( A \) entails the literal meaning of \( B \). There is no simple expression for the concept “\( B \) but not \( A \).” In this scenario, a usage of “\( B \)” will implicate that \( A \) is false.
The I-Heuristics. Levinson assumes two further pragmatic principles that, together with the Q-heuristics, are supposed to replace Grice’s maxims in the derivation of generalized conversational implicatures. The second heuristics, called I-heuristics, says: “What is simply described is stereotypically exemplified.” It accounts for phenomena of pragmatic strengthening, as illustrated in the following examples:

(3) a. John’s book is good. \(\rightsquigarrow\) The book that John is reading or that he has written is good.

b. a secretary \(\rightsquigarrow\) a female secretary

c. road \(\rightsquigarrow\) hard-surfaced road

The notion of “stereotypically exemplification” is somewhat vague and difficult to translate into the language of game theory. We will assume that stereotypical propositions are those with a high prior probability and that simplicity of descriptions can be translated into low signaling costs. So the principle amounts to “Likely propositions are expressed by cheap forms”.

Let us construct a schematic example of such a scenario. Suppose there are two possible worlds (which may also stand for objects, like a hard surfaced vs. soft-surfaced road) \(w_1\) and \(w_2\), such that \(w_1\) is a priori much more likely than \(w_2\), say \(p^*(w_1) = 3/4\) and \(p^*(w_2) = 1/4\). There are three possible actions for Robin: he may choose \(a_1\) if he expects \(w_1\) to be correct, \(a_2\) if he expects \(w_2\), and \(a_3\) if he finds it too risky to choose.

There are again three signals, \(f_1\), \(f_2\) and \(f_{12}\). This time the more general expression \(f_{12}\) (corresponding for instance to “road”) is cheap, while the two specific expressions \(f_1\) (“hard-surfaced road”) and \(f_2\) (“soft-surfaced road”) are more expensive: \(c(f_1) = c(f_2) = 5\), and \(c(f_{12}) = 0\).

The interests of Sally and Robin are completely aligned, except for the signaling costs which only matter for Sally. There are three contexts (13). In \(c_1\) and \(c_2\), it is safest for Robin to choose \(a_3\) if he decides on the basis of the prior probability. In \(c_3\) it makes sense to choose \(a_1\) if he only knows the prior probabilities because the payoff of \(a_3\) is rather low (but still higher than making the wrong choice between \(a_1\) and \(a_2\)). In \(c_1\), but not in \(c_2\) it would be rational for Sally to use a costly message if this is the only way to make Robin perform \(a_1\) rather than \(a_3\).

\[
\begin{array}{ccc}
\begin{array}{ccc}
\hline
& a_1 & a_2 & a_3 \\
\hline
w_1 & 28 & 0 & 22 \\
\hline
w_2 & 0 & 28 & 22 \\
\end{array} & \begin{array}{ccc}
\hline
& a_1 & a_2 & a_3 \\
\hline
w_1 & 28 & 0 & 25 \\
\hline
w_2 & 0 & 28 & 25 \\
\end{array} & \begin{array}{ccc}
\hline
& a_1 & a_2 & a_3 \\
\hline
w_1 & 28 & 0 & 10 \\
\hline
w_2 & 0 & 28 & 10 \\
\end{array}
\end{array}
\]
Here both \( f_1 \) and \( f_2 \) retain their literal meaning under pragmatic rationalizability. The unspecific \( f_{12} \) also retains its literal meaning in \( c_2 \). In \( c_1 \) and \( c_3 \), though, its meaning is pragmatically strengthened to \( \{ w_1 \} \). Another way of putting is to say that \( f_{12} \) is pragmatically ambiguous here. Even though it has an unambiguous semantic meaning, its pragmatic interpretation varies between contexts. It is noteworthy here that \( f_{12} \) can never be strengthened to mean \( \{ w_2 \} \). Applying it to the example, this means that a simple non-specific expression like “road” can either retain its unspecific meaning, or it can be pragmatically strengthened to its stereotypical instantiation (like “hard-surfaced road” here). It can never be strengthened to a non-stereotypical meaning though.

**M-Heuristics.** Levinson’s third heuristics is the **M-heuristics**: “What is said in an abnormal way isn’t normal.” It is also known, after Horn (1984), as division of pragmatic labor. A typical example is the following:

(4)  

a. John stopped the car.

b. John made the car stop.

The two sentences are arguably semantically synonymous. Nevertheless they carry different pragmatic meanings if uttered in a neutral context. (4a) is preferably interpreted as **John stopped the car in a regular way, like using the foot brake.** This would be another example for the I-heuristics. (4b), however, is also pragmatically strengthened. It means something like **John stopped the car in an abnormal way, like driving it against a wall, making a sharp u-turn, driving up a steep road, etc.**

This can be modeled quite straightforwardly. Suppose there are again two worlds, \( w_1 \) and \( w_2 \), such that \( w_1 \) is likely and \( w_2 \) is unlikely (like using the foot brake versus driving against a wall). Let us say that \( p^*(w_1) = 3/4 \) and \( p^*(w_2) = 1/4 \) again. There are two actions, \( a_1 \) and \( a_2 \), which are best responses in \( w_1 \) and \( w_2 \) respectively. There is only one context. The utilities are given as follows:

<table>
<thead>
<tr>
<th></th>
<th>( a_1 )</th>
<th>( a_2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( w_1 )</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>( w_2 )</td>
<td>0</td>
<td>5</td>
</tr>
</tbody>
</table>

(14)
Unlike in the previous example, we assume that there are only two expressions, \( f \) and \( f' \), which are both unspecific: \( [f] = [f'] = \{w_1, w_2\} \). \( f' \) is slightly more expensive than \( f \), say \( c(f) = 0 \) and \( c(f') = 1 \).

\[
\begin{align*}
R_0 &= \begin{bmatrix} f / f' & \rightarrow & a_1 \end{bmatrix} & S_0 &= \begin{bmatrix} w_1 / w_2 & \rightarrow & f \end{bmatrix} \\
R_1 &= \begin{bmatrix} f & \rightarrow & a_1 \\
 & f' & \rightarrow & a_1 / a_2 \end{bmatrix} & S_1 &= \begin{bmatrix} w_1 & \rightarrow & f \\
 & w_2 & \rightarrow & f / f' \end{bmatrix} \\
R &= R_2 = \begin{bmatrix} f & \rightarrow & a_1 \\
 & f' & \rightarrow & a_2 \end{bmatrix} & S &= S_2 = \begin{bmatrix} w_1 & \rightarrow & f \\
 & w_2 & \rightarrow & f' \end{bmatrix}
\end{align*}
\]

The crucial point here is that in \( S_0 \), the signal \( f' \) remains unused. Therefore any rationalizable interpretation of \( f' \) which is compatible with its literal meaning is licit in \( R_1 \), including the one where \( f' \) is associated with \( w_2 \) (which triggers the reaction \( a_2 \)). Robin’s reasoning at this stage can be paraphrased as: If Sally uses \( f \), this could mean either \( w_1 \) or \( w_2 \). Since \( w_1 \) is a priori more likely, I will choose \( a_1 \). There is apparently no good reason for Sally to use \( f' \). If she uses it nevertheless, she must have something in mind which I hadn’t thought of. Perhaps she wants to convey that she is actually in \( w_2 \).

Sally in turn reasons: If I say \( f \), Robin will take action \( a_1 \). If I use \( f' \), he may take either action. In \( w_1 \) I will thus use \( f \). In \( w_2 \) I can play it safe and use \( f \), but I can also take my chances and try \( f' \).

Robin in turn will calculate in \( R_2 \): If I hear \( f \), we are in \( w_1 \) with a confidence between 75% and 100%. In any event, I should use \( a_1 \). The only world where Sally would even consider using \( f' \) is \( w_2 \). So if I hear \( f' \) we are surely in \( w_2 \) and I can safely choose \( a_2 \). If Robin reasons this way, it is absolutely safe for Sally to use \( f' \) in \( w_2 \).

## 4 Conclusion

We proposed a game theoretic formalization of Gricean reasoning that both captures the intuitive reasoning patterns that are traditionally assumed in the computation of implicatures. The essential intuition behind the proposal is that the literal meaning of signals constitutes their default interpretation, and that rational communicators decide about their communicative strategies by iteratively calculating the best response to this default strategy.

Concerning related work, Franke (2008) proposes to calculate the pragmatically licit communication strategies by starting with a strategy based on the literal interpretation of signals and iteratively computing the best response strategy until a fixed point is reached. So this approach is very similar in spirit to the present one. The main differences are that Franke uses a particular honest sender strategy — rather than the set of all credulous receiver strategies — as the starting point of the iteration process, and that he uses deterministic best response calculation, rather than potential best responses, as update rule.
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References


The Interpretation of Questions in Dialogue

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Abstract

We propose a dynamic semantics of questions in dialogue that tracks the public commitments of each dialogue agent, including commitments to issues raised by questions.

1 Introduction

A semantic framework for interpreting dialogue should provide an account of the content that is mutually accepted by its participants. The acceptance by one agent of another’s contribution crucially involves the theory of what that contribution means; A’s acceptance of B’s contribution means that the content of B’s contribution must be integrated into A’s extant commitments.\textsuperscript{1} For assertions, traditionally assumed to express a proposition formalised as a set of possible worlds, it was clear how the integration should go: acceptance meant intersecting the newly accepted proposition with the set of worlds representing the content of the agent’s prior commitments. Dynamic semantics (e.g., Asher (1989)) refined this picture by replacing intersection with the operation of dynamic update. The way to treat the negative counterpart of acceptance—namely, rejection—is also clear in principle: A’s rejection of B’s assertion means that the negation of the content of B’s contribution should be integrated with the content of A’s prior commitments.

However, acceptance and rejection don’t just happen with assertions. These speech acts can happen with questions as well. That is, an agent can choose to address the issues raised by the questioner; he can also choose to reject them. The explicit acceptance of a question can be conveyed by providing a direct answer or by an explicit admittance that one doesn’t know an answer; explicit rejection by uttering I won’t answer.

Agents can also signal acceptance or rejection of questions via implicature, just as they can indicate acceptance or rejection of assertions by implicature, as Lascarides and Asher (2009), following (Hamblin, 1987, p.240), argue that public commitment is the appropriate mental attitude of a speaker towards his own dialogue moves and the moves that he accepts. We adopt this standpoint here as well.

\textsuperscript{1}Lascarides and Asher (2009), following (Hamblin, 1987, p.240), argue that public commitment is the appropriate mental attitude of a speaker towards his own dialogue moves and the moves that he accepts. We adopt this standpoint here as well.
and Asher (2009) show. For instance, compare (1) (from dialogue r053c in the VerbMobil corpus (Wahlster, 2000)) with the excerpt (2) of a press conference given by Mr. Sheehan, the aide to Senator Coleman (see www.youtube.com/watch?v=VySnpLoaUrI).

(1) a. A: Can you meet in the morning?
b. B: How about eight thirty to ten?

(2) a. REPORTER: On a different subject is there a reason that the Senator won’t say whether or not someone else bought some suits for him?
b. SHEEHAN: Rachel, the Senator has reported every gift he has ever received.
c. REPORTER: That wasn’t my question, Cullen.
d. SHEEHAN: The Senator has reported every gift he has ever received. We are not going to respond to unnamed sources on a blog.
e. REPORTER: So Senator Coleman’s friend has not bought these suits for him? Is that correct? [The dialogue continues with Sheehan repeating (2)b to every request for information from the reporters]

In (1), B responds to A’s question with a question; but B’s question, given its content, also implicates that he accepts the issues raised by A’s question (i.e., he is indicating his willingness to help answer (1)a). In (2), Sheehan’s assertion (2)b is clearly not an answer to the question (2)a, and in (2)c the reporter (correctly) takes it as a refusal to answer. This refusal is not explicit—like uttering I won’t answer would be—but implicit.

In this paper we propose an account of acceptance and rejection of questions. Standard theories of the semantics of questions (Kartunnen (1977), Groenendijk and Stokhof (1982) or Ginzburg (1995)) are difficult to integrate with an intuitive theory of acceptance and rejection. All of these theories take the content of a question to be its set of answers (they differ on what counts as an answer in context and on whether the set denoted by the question includes only true or both true and false answers). But how can we use such a set of answers to update the commitments of an agent who accepts or refuses a question?

Some theories model acceptance in terms of an agent’s commitments to a set of propositions, but it is clear from the way these sets are conceived that the elements in the set are understood intersectively; i.e., the set representation is just another way of formulating the traditional approach to acceptance. This will not work with the semantics of questions in general, and it’s easy to see why: the set of answers to a question are often inconsistent with each other. For instance, the semantics of a yes/no question like Did you take the garbage out? is given in terms of two propositions: You took the garbage out, and you did not take the garbage out. Taking the intersection of these two propositions yields an empty set. Conceivably, if a question denotes only answers that are true at the world of evaluation, one might avoid this absurd result. But it has equally bad consequences for acceptance: it would imply that agents who accept questions are always committed to its true answers; and thus one can’t truthfully respond to a yes/no question with I don’t know but your question is an interesting one, since the responding agent is already committed to the true answer (be it positive, or negative). Thus, tradi-

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2Thanks to Chris Potts for bringing this example to our attention.
tional semantic analyses of questions appear to be incompatible with intuitive accounts of acceptance and rejection.

If the formal semantics of questions is to be made relevant to accounting for the basic phenomena of acceptance and rejection in dialogue, it has to change. That is what we propose to do in this paper. There is additional pressure on the traditional semantics of questions from data on embedded speech acts: Asher (2007) argues that it cannot adequately handle questions embedded within other operators like conditionals—as in If I buy into this plan, what can I expect my returns to be? Asher (2007) provides a dynamic, first order adaptation of Groenendijk’s (2003) semantics for questions to recursively compute appropriate values for embedded speech acts; the general idea is to use a question’s direct, exhaustive answers to form a partition over the input information state and then to lift the dynamic semantics of other operators and quantifiers so as to define them as transitions from an input partition to an output partition. In this paper, we demonstrate that this semantics is also the basis for a uniform account of the acceptance (and rejection) of questions and assertions in dialogue. It achieves this by making the input and output contexts for interpreting propositions and questions of the same type, and so an agent can be simultaneously committed to questions and propositions and also share those commitments with other agents.

We motivate and describe our model in Section 2, and in Section 3 we define the dynamic semantics for questions and show how it makes intuitively compelling predictions about acceptance and rejection.

## 2 Background

To our knowledge, there is currently no formally precise, adequate account of acceptance (and rejection) of both propositions and questions in dialogue. The Grounding Acts Model (GAM, Traum (1994), Poesio and Traum (1998)) addresses the effects of both questions and assertions on an information state. In Poesio and Traum’s (1998) formalisation of GAM, agreement occurs when one agent accepts a prior assertion that’s made by another agent. Questions, on the other hand, create an obligation on the interlocutor to respond, but GAM as it stands does not address the issue of predicting when the response conveys, indirectly, that the speaker is prepared to answer the question (as in (1)). So GAM needs to be supplemented to account for this data.

Asher and Lascarides’ (2003) SDRT also addresses updates with questions and assertions. But its traditional semantics for questions makes it fall prey to the problem about acceptance that we described in Section 1. While Ginzburg (1995) provides very detailed predictions for when a question is resolved, his theory does not predict when an agent rejects the question; indeed he observes in Ginzburg (2009) that being a question under discussion is a necessary but not a sufficient condition for both acceptance and rejection of the issues raised by the question.

Lascarides and Asher (2009) argue that Poesio and Traum’s (1998) rules for identifying speech acts undergenerate acceptance in many cases and that SDRT from Asher and Lascarides (2003) errs in the opposite direction to GAM by overgenerating acceptance. To correct these problems, Lascarides and Asher (2009) propose a logical
form for dialogue that tracks each agent’s public commitments. They argue that these include commitments to *rhetorical connections* (e.g., *Narration*) among utterances in the dialogue, on the grounds that recognising implicit acceptance and identifying the rhetorical connection that links an agent’s utterance to the dialogue context are logically co-dependent. So they propose that each agent’s commitments at any given stage in the dialogue be represented as a Segmented Discourse Representation Structure (SDRS): this is a set of *labels* that each represent a unit of discourse, and a function that associates each label with a formula representing the unit’s interpretation. These formulae include rhetorical relations among labels.

To see how this framework handles both acceptance and rejection, consider (3), an example where A accepts a denial of his prior assertion:

(3) \[ \pi_{1.1}. A: \text{It’s raining.} \]
\[ \pi_{2.1}. B: \text{No it’s not.} \]
\[ \pi_{3.1}. A: \text{Oh, you’re right (uttered after looking out the window).} \]

The logical form of a dialogue turn (where a turn boundary occurs whenever the speaker changes) is a tuple of SDRSs: one for each agent, representing his public commitments. The logical form of dialogue—known as a Dialogue SDRS or DSDRS—is the logical form of each of its turns, yielding Table 1 as the logical form for dialogue (3). For reasons of space, the logical forms of the clauses are omitted from Table 1. We will often gloss the content of a label \( \pi \) as \( K \pi \), and use \( \pi_{nd} \) to label the dialogue segment of turn \( n \) with (unique) speaker \( d \), and \( \pi_{n.i} \) to label the \( i^{th} \) elementary discourse unit that is part of the turn \( \pi_{nd} \). The glue-logic inference that \( \text{Correction}(\pi_{1.1}, \pi_{3.1}) \) is a part of A’s commitments in turn 3 arises from the fact that \( \pi_{3.1} \) is an *Acceptance* of the corrective move \( \pi_{2.1} \) (see Lascarides and Asher (2009)). The SDRSs in a DSDRS share labels because a speaker can perform a relational speech act whose first argument is part of a prior turn (e.g., \( \pi_{1.1} \) and \( \pi_{2.1} \) are literals in A’s SDRS for turn 3 in Table 1). As a special case, it captures the fact that an agent can reveal his commitments (or lack of them) to content that another agent conveyed, even if this is linguistically implicit.

To see how DSDRSs capture facts about acceptance and rejection, let’s review how they’re are interpreted. Asher and Lascarides (2003) define precisely the *context change potential* (CCP) of an individual SDRS. Since the logical form of a dialogue turn is now a tuple of SDRSS, its CCP is the product of the CCPs of the individual SDRSSs. In other words, the context of evaluation \( C_d \) for interpreting a dialogue turn is a set of dynamic contexts for interpreting SDRSSs—one for each agent \( a \in D \), where \( D \) is the set of dialogue agents. Thus, where \( C_d^i \) and \( C_d^o \) are respectively an input and output context

<table>
<thead>
<tr>
<th>Turn</th>
<th>A’s SDRS</th>
<th>B’s SDRS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>( \pi_{1.1}: K_{\pi_{1.1}} )</td>
<td>( \emptyset )</td>
</tr>
<tr>
<td>2</td>
<td>( \pi_{1.1}: K_{\pi_{1.1}} )</td>
<td>( \pi_{2B}: \text{Correction}(\pi_{1.1}, \pi_{2.1}) )</td>
</tr>
<tr>
<td>3</td>
<td>( \pi_{3A}: \text{Correction}(\pi_{1.1}, \pi_{3.1}) \wedge \text{Acceptance}(\pi_{2.1}, \pi_{3.1}) )</td>
<td>( \pi_{2B}: \text{Correction}(\pi_{1.1}, \pi_{2.1}) )</td>
</tr>
</tbody>
</table>

Table 1: The logical form of dialogue (3).
for evaluating an SDRS:

\[ C_d = \{ \langle C^d_a, C^o_a \rangle : a \in D \} \]

The semantics of a dialogue turn \( T = \{ S_a : a \in D \} \) is the product of the CCPs its SDRSs, as shown in (4) (\( m \) in \( \llbracket \cdot \rrbracket_m \) stands for monologue and \( d \) in \( \llbracket \cdot \rrbracket_d \) for dialogue):

\[ C_d \llbracket T \rrbracket_d C'_d \quad \text{iff} \quad C'_d = \{ \langle C^d_a, C^o_a \rangle \circ \llbracket S_a \rrbracket_m : \langle C^d_a, C^o_a \rangle \in C_d, a \in D \} \]

And given that a turn represents all of each agent’s current commitments, the CCP of a DSDRS is that of its last turn. Dialogue entailment is then defined in terms of the entailment relation \( \models_m \) afforded by \( \llbracket \cdot \rrbracket_m \) of SDRS:

\[ T \models_d \phi \quad \text{iff} \quad \forall a \in D, S_a \models_m \phi \]

Thus \( \models_d \) defines shared public commitments, and we assume that \( \phi \) is mutually accepted in turn \( T \) among \( D \) if \( T \models_d \phi \). Similar definitions hold for acceptance among a subgroup \( D' \subseteq D \). i.e., for all \( a \in D' \), \( S_a \models_m \phi \).

Equation (6) defines the dynamic interpretation of veridical relations (e.g., Narration, Explanation, Acceptance), ensuring that a discourse unit consisting of veridical relations entails its smaller discourse units plus the relations’ illocutionary effects \( \varphi_R(\alpha, \beta) \):

\[ C^i \llbracket R(\alpha, \beta) \rrbracket_m C^o \quad \text{iff} \quad C^i \llbracket \langle K_\alpha \land K_\beta \land \varphi_R(\alpha, \beta) \rangle \rrbracket_m C^o \]

\[ C^i \llbracket \text{Correction}(\alpha, \beta) \rrbracket_m C^o \quad \text{iff} \quad C^i \llbracket \langle \neg K_\alpha \land K_\beta \land \varphi_{\text{Corr}(\alpha, \beta)} \rangle \rrbracket_m C^o \]

Meaning postulates then constrain the content \( \varphi_R(\alpha, \beta) \): e.g., \( \varphi_{\text{Explanation}(\alpha, \beta)} \) entails \( K_\beta \) is an answer to Why \( K_\alpha \) ? Equation (7) is the interpretation of Correction and it entails the negation of the denied segment.

These definitions capture intuitions about acceptance and rejection for dialogue (3), given its logical form in Table 1. Assuming that \( K_{\pi_{1.1}} \) to \( K_{\pi_{2.1}} \) are expressed appropriately, turn 2 in Table 1 entails that \( A \) is committed in \( K_{\pi_{1.1}} \) while \( B \) rejects it (for his commitments entail \( \neg K_{\pi_{1.1}} \)), a rejection that \( A \) then accepts in turn 3. The CCP of Table 1 thus reflects intuitions about changing commitments and agreement. At the end of turn 3 both agents agree that it’s not raining, and \( A \) has dropped an earlier commitment in favour of an incompatible commitment. The DSDRS is consistent even though \( A \)’s SDRS for turn 2 is inconsistent with his SDRS for turn 3, and the SDRSs for turn 2 are inconsistent with each other.

This formalism provides logical forms for dialogues involving questions as well, as shown in Tables 2 and 3, the proposed logical forms for dialogues (1) and (2) respectively. Consider Table 2 first. The relation \( Q-\text{Elab}(\pi_{1.1}, \pi_{2.1}) \) —which means that \( \pi_{2.1} \) is a question all of whose possible answers elaborate a plan to achieve the goal of \( \pi_{1.1} \).
when he knows it, and S in inference to the speech act Plan-Elab that prompted it; namely, for S’s implication that S’s earlier question that R’s assertion particular content R’s utterance is a commentary on the fact that S’s has a serious defect in its semantics for questions, which undermines the generality of its model of acceptance. We will now remedy this defect.

The DSDRS for (2) in Table 3 (R is the reporter and S is Sheehan) contains lots of implicit rejections. Again, we have omitted the logical forms of clauses because of space. The lack of a relation between S’s utterance π_{2,1} and R’s question π_{1,1} implicates a rejection by S of the question (although, as we’ve mentioned, to ensure that this intended interpretation is reflected in the model theory, we must revise the semantics of questions).³ R’s commitments in turn 3 are to Commentary^∗(π_{2,1}, π_{3,1})—that is, his utterance is a commentary on the fact that S said π_{2,1} (rather than a commentary on its content K_{π_{2,1}}). Thus the semantics of this relation does not entail K_{π_{2,1}}, indicating R’s lack of commitment to it. Result^∗(π_{4B}, π_{5,1}) in S’s DSDRS for turn 5 likewise entails that a particular assertion π_{4B} was made but not that assertion’s content (in contrast to Result): it entails that S making the assertions he did leads to the question π_{5,1} (which is in effect the earlier question that R asked). So R does not accept the content of S’s assertions, just as S doesn’t accept the issues raised by the question.

Note that acceptance and rejection in dialogue (2) are implicated but not part of semantic content. This is because anaphoric tests suggest that these acts, while implicated, are not a part of what the agents said: the reporter cannot coherently respond to (2)b with Why? (meaning “why are you refusing to answer the question?”). SDRT distinguishes what was said from its cognitive effects partly so as to account for these anaphoric effects: antecedents to surface anaphors must be chosen from SDRSSs, while cognitive effects are validated within a separate cognitive logic not discussed here (but see Asher and Lascarides (2008)).

However, as we mentioned before, the dynamic interpretation Lascarides and Asher (2009) provide for DSDRSs has a serious defect in its semantics for questions, which undermines the generality of its model of acceptance. We will now remedy this defect.

³Readers familiar with SDRT may wonder why S’s SDRS is not π_{2S}: Plan-Elab(π_{1,1}, π_{2,1})—this would implicate that S accepts R’s question, because it entails that π_{2,1} elaborates a plan to achieve the intention that prompted it; namely, for R to know an answer. While K_{π_{2,1}} is compatible with the semantics of Plan-Elab(π_{1,1}, π_{2,1}), an inference to this relation is blocked by knowledge of S’s mental state: namely, R and S mutually know that S, being an aide to the senator, knows the answer. By S not providing an answer when he knows it, R can infer that S does not adopt R’s intention for R to know an answer, and thus an inference to the speech act Plan-Elab is not validated.
2.1 Questions

The semantics of SDRSs in Asher and Lascarides (2003), on which the model of dialogue in Lascarides and Asher (2009) is based, incorporates a traditional semantics of questions, according to which the meaning of a question is given by its set of (true) answers (in this it follows Groenendijk and Stokhof (1982) but agrees with Ginzburg (1995) that those answers need not be exhaustive). More formally, the context of evaluation in SDRT is a pair of elements \((w, f)\), where \(w\) is a possible world and \(f\) is a partial variable assignment function. But the CCP of a question transforms an input state \((w, f)\) into an output state of a different type: a set of dynamic propositions, each proposition being a true answer. In other words, the output state of a question is a set of pairs of world assignment pairs.

While this semantics of questions has a certain appeal when considered in isolation, it is problematic when questions are part of the content of an extended dialogue. This is because the output context of a question cannot be the input context for interpreting a subsequent discourse unit. Therefore, questions cannot be arguments to veridical rhetorical relations, given their CCP in (6). And yet intuitively, the second question in (2)e should be construed as elaborating the first question in (2)e (as we’ve shown in Table 3), since all true answers to one entail a true answer to the other. Asher and Lascarides (2003) provide many more examples where questions can enter into relations that are normally associated with assertions, like Explanation and Narration.

SDRT as described in Asher and Lascarides (2003) bypasses this problem by introducing a distinct relation Elaboration\(_{qq}\) for connecting an ‘elaborating’ question to the question it elaborates. Semantically, the CCP of Elaboration\(_{qq}(\pi_{1,1}, \pi_{2,1})\) makes it a test on the input context: in words, the input context \((w, f)\) must be such that \(K_{\pi_{1,1}}\) and \(K_{\pi_{1,2}}\) are questions, and any true answer to \(K_{\pi_{2,1}}\) in \((w, f)\) entails a true answer to \(K_{\pi_{1,2}}\) in \((w, f)\). Similar additional relations are introduced for other veridical rhetorical relations—e.g., Explanation\(_{qp}\) and Narration\(_{pq}\).

But the problems go much deeper than this. The proliferation of non-veridical relations for handling questions is not just an inconvenience; it is a fatal flaw in our proposed model of acceptance. If \(R\)’s commitments in turn 5 are represented in terms of Elaboration\(_{qq}\), then \(R\) is not committed even to his own questions, contrary to intuitions. Rather, he is simply committed to the two questions being in a certain semantic relationship. Similarly, consider the relation Q-Elab\((\pi_{1,1}, \pi_{2,1})\), which forms part of \(B\)’s SDRS for turn 2 of (1). As we said, this expresses the information that \(K_{\pi_{2,1}}\) is a question and any of its possible answers elaborate a plan to achieve the communicative goal behind \(K_{\pi_{1,1}}\) (that \(A\) know an answer to the question \(K_{\pi_{1,1}}\)). But out of technical necessity the CCP of Q-Elab from Asher and Lascarides (2003) is a test on the input context, and so \(B\)’s SDRS does not commit him to \(K_{\pi_{2,1}}\) or \(K_{\pi_{1,1}}\). This undergenerates what’s accepted for (1): it makes \(B\) committed to the answers of \(\pi_{2,1}\) bearing a certain semantic relationship with those of \(\pi_{1,1}\), but it fails to commit \(B\) to \(A\)’s question, and therefore also fails to predict that \(R\)’s responses to \(S\)’s question in (2) are different in this respect from \(B\)’s responses to \(A\)’s in (1).

Ideally, we want a semantics for questions that is compatible with an agent being committed to it. This requires the input and output contexts for questions and for
propositions to be of uniform type, allowing both of them to be arguments to veridical rhetorical relations. This would not only solve the problem with acceptance that we have just described, but it would also simplify the inventory of rhetorical relations: a question could be an argument to Elaboration, obviating the need for the distinct relation Elaboration$_{qq}$ that comes with similar implicatures to Elaboration; similarly for all other veridical relations. Groenendijk’s (2003) semantics of questions assumes uniform input and output contexts for both propositions and questions. Asher (2007) generalises this semantics to provide a dynamic treatment of variables and quantifiers so as to preserve SDRT’s predictions about anaphora (Groenendijk treats quantifiers statically). This is the semantics that we will adopt here. While the semantic type of the contexts $C_i$ and $C_o$ for SDRSs will change, the definitions (4) and (5) for interpreting DSDRSSs will be unchanged.

3 Formal Syntax and Semantics

Before we refine the formal semantics of questions, we must define the language’s syntax. We start with the syntax of so-called SDRS-formulae from which DSDRSSs are built (Definition 1 is from Asher and Lascarides (2003)).

**Definition 1**  The Syntax of SDRS-Formulae

SDRS-formulae are constructed from the following vocabulary:

vocab-1. A classical first order vocabulary, augmented with the modal operator $\delta$ that turns formulae into action terms ($\delta \phi$ is the action of bringing it about that $\phi$ and this is used to represent imperatives); and the operator ‘?’ and $\lambda$-terms for representing questions as $?\lambda x_1 \ldots \lambda x_n \phi$, each $x_i$ corresponding to a $wh$-element.

vocab-2. labels: $\pi, \pi_1, \pi_2$, etc.

vocab-3. a set of symbols for rhetorical relations: $R, R_1, R_2$, etc.

The set $\mathcal{L}$ of well-formed SDRS-formulae is defined as follows:

1. Let $\mathcal{L}_{\text{basic}}$ be the set of well-formed formulae that are derived from vocab-1 using the usual syntax rules for first order languages with action terms and questions. Then $\mathcal{L}_{\text{basic}} \subseteq \mathcal{L}$.

2. If $R$ is an $n$-ary discourse relation symbol and $\pi_1, \ldots, \pi_n$ are labels, then $R(\pi_1, \ldots, \pi_n) \in \mathcal{L}$.

3. For $\phi, \phi' \in \mathcal{L}$, $(\phi \land \phi'), \neg \phi \in \mathcal{L}$.

Definition 2 reflects the logical forms proposed in Lascarides and Asher (2009) and illustrated in Tables 1 to 3. It maps each dialogue turn and agent into an SDRS: that is, a rooted and well-founded partial order of labels, each one standing for a discourse unit and associated with a representation of its content. For simplicity, we have ignored Asher and Lascarides’ (2003) notion of a last label in these definitions, since we won’t be focussing on anaphora in this paper.
Definition 2. **DSDRSs**

Let $D$ be a set of dialogue participants. Then a Dialogue SDRS (or DSDRS) is a tuple $\langle n, T, \Pi, f \rangle$, where:

- $n \in \mathcal{N}$ is a natural number (intuitively, $j \leq n$ is the $j^{th}$ turn in the dialogue);
- $\Pi$ is a set of labels;
- $f$ is a function from $\Pi$ to the SDRS-formulae $L$;
- $T$ is a mapping from $[1, n]$ to a function from $D$ to SDRSs drawn from $\Pi$ and $f$. That is, if $T(j)(a) = \langle \Pi_j^a, f_j^a \rangle$ where $j \in [1, n]$ and $a \in D$, then $\Pi_j^a \subseteq \Pi$ and $f_j^a = \{ \delta \} \cap \Pi_j^a$ (that is, $f_j^a$ is $f$ restricted to $\Pi_j^a$).

Furthermore, let $\pi \succ^a \pi'$ iff $\pi'$ is a literal in $f_j^a(\pi)$ or a literal in $f_j^a(\pi')$ where $\pi \succ^a \pi'$. Then $\succ^a$ is a well-founded partial order with a unique root.

There are many notational variants for DSDRSs—Table 1 is a notational variant of the DSDRS (8) for example:

\[
(8) \quad \langle 2, T, \{\pi_{2B}, \pi_{3A}, \pi_{1,1}, \pi_{1,2}, \pi_{2,1}, \pi_{3,1}\}, F \rangle,
\]

- $F(\pi_{1,1}) = K_{\pi_{1,1}}$, $F(\pi_{2,1}) = K_{\pi_{2,1}}$, $F(\pi_{3,1}) = K_{\pi_{3,1}}$
- $F(\pi_{2B}) = \text{Correction}(\pi_{1,1}, \pi_{2,1})$
- $F(\pi_{2K}) = \text{Correction}(\pi_{1,1}, \pi_{3,1}) \land \text{Acceptance}(\pi_{2,1}, \pi_{3,1})$
- $T(1) = \{(A, \{\pi_{1,1}\}, F_1), (B, \emptyset)\}$, where $F_1 = F \upharpoonright \{\pi_{1,1}\}$
- $T(2) = \{(A, \{\pi_{1,1}\}, F_1), (B, \{\pi_{2B}, \pi_{1,1}, \pi_{2,1}\}, F_2)\}$
  where $F_2 = F \upharpoonright \{\pi_{2B}, \pi_{1,1}, \pi_{2,1}\}$
- $T(3) = \{(A, \{\pi_{3A}, \pi_{1,1}, \pi_{2,1}, \pi_{3,1}\}, F_3), (B, \{\pi_{2B}, \pi_{1,1}, \pi_{2,1}\}, F_2)\}$
  where $F_3 = F \upharpoonright \{\pi_{3A}, \pi_{1,1}, \pi_{2,1}, \pi_{3,1}\}$

Definition 2 allows label sharing across speakers and turns but the content assigned to a label is unique: $\forall \pi \in \Pi_j^{a_1} \cap \Pi_j^{a_2}$, $j, k \in [1, n]$, $a_1, a_2 \in D$, $f_j^{a_1}(\pi) = f_j^{a_2}(\pi)$. A situation where $a_1$ and $a_2$ interpret $\pi$ differently won’t correspond to a situation where $\pi$ is assigned distinct contents in distinct SDRSs within the same DSDRS. Rather, it corresponds to a situation where $a_1$ and $a_2$ each build different DSDRSs (although we won’t explore misunderstandings further here).

With the syntax of the formal language in place, let’s define its semantics. As we explained in Section 2.1, the semantics $[.]_\delta$ of DSDRS requires the input and output contexts for propositions, questions and requests to be the same. We now adapt the semantics from Asher and Lascarides (2003) to meet this criterion. We start with a few illustrative clauses of the distributive, non-eliminative CCP for $L_{\text{basic}}$ from Asher and Lascarides (2003), which we refer to here as $[.]_\delta$. Our new semantics $[.]_m$ of SDRSS will be defined in terms of $[.]_\delta$. Both $[.]_\delta$ and $[.]_m$ are defined with respect to a model $M = \langle \Delta, W, I \rangle$, where $\Delta$ is a set of individuals, $W$ is a set of possible worlds and $I$ is an interpretation function that maps $n$-place predicates into sets of $n$-tuples from $\Delta$. 
The CCP \([.]_5\) from Asher and Lascarides (2003) treats all formulae save \(\exists x\), conjunctions, imperatives and questions as tests on the input context. For instance: 
\[(w, f)[P(x)]_5(w', g) \iff (w, f) = (w', g) \text{ and } f(x) \in I(P); \text{ and } (w, f)[\neg \phi]_5(w', g) \iff (w, f) = (w', g) \text{ and there is no } (w'', k) \text{ such that } (w, f)(w'', k)\]. Conjunction is interpreted as dynamic succession: 
\[(w, f)[\phi \land \psi]_5(w', g) \iff (w, f)[\phi]_5 \circ [\psi]_5(w', g)\]. Questions, as we have already stated, transform an input context \((w, f)\) into a set of propositions that are its true (non-exhaustive) answers (see Asher and Lascarides (2003) for details). The formula \(\exists x\) updates the input variable assignment function: 
\[(w, f)[\exists x]_5(w', g) \iff \text{dom}(g) = \text{dom}(f) \cup \{x\} \text{ and } f \subseteq g \text{ (i.e., } \forall y \in \text{dom}(f), f(y) = g(y))\]. Note that \(\exists x\phi\) is syntactic sugar for \(\exists x \land \phi\). Action terms, on the other hand, update the world: 
\[(w, f)[\delta \phi]_5(w', g) \iff (w', f)[\phi]_5(w', g)\].

Following Asher (2007), we will ‘lift’ the distributive semantics \([.]_5\) to a collective semantics \([.]_m\) so that it can incorporate the collective semantics to questions proposed in Groenendijk (2003). This strategy results in a uniform type of input and output context for all formulae. Asher demonstrates that this allows questions to be embedded in conditionals (e.g., If you’re serious, what’s his name?). Here, we demonstrate that it also properly accounts for their rhetorical role in dialogue, including their role in acceptance.

For Groenendijk, a question partitions the input information state, which in turn consists of all the world assignment pairs that have not been ruled out by prior assertions. Each equivalence class in the output partition represents a different possible answer to the question. Thus the input and output contexts \(C_m\) are always a subset of \((W \times F)^2\), where \(W\) is the set of possible worlds and \(F\) is the set of partial variable assignment functions, and \(\{(w, f), (w', g)\} \in C_m\) means that \((w, f)\) and \((w', g)\) are in the same equivalence class. One can intuitively interpret the equivalence class in terms of the agent’s attitudes: if \(\{(w, f), (w', g)\} \in C_m\), then the agent ‘doesn’t care’ about the different interpretations to formulae that these world-assignment pairs define. If, on the other hand, \((w, f)\) and \((w', g)\) are in different classes of \(C_m\) then the agent does care—he is committed to a question whose true answers are different in \((w, f)\) vs. \((w', g)\). Assertions that are subsequent to a question may then remove all but one equivalence class from the partition that’s created by the question; if so, the question is answered.

Informally, then, our new dynamic semantics \([.]_m\) for SDRS-formulae is as follows. For those formulae \(\phi\) where \([.]_5\) imposes a test on the input context—so \(\phi\) is not of the form \(\exists x, \psi \land \chi, \delta \psi\) or \(?\psi\)—\([\phi]_m\) has an entirely eliminative and distributive semantics. In other words, any element \(\{(w, f), (w', g)\}\) from the input context \(C\) will survive as an element of the output context \(C'\) iff \((w, f)[\phi]_5(w', g)\). \(\exists x\), on the other hand, changes the input assignment functions \(f\) and \(g\), by extending them to be defined for \(x\). \(\delta \phi\) changes the input worlds. Conjunction is dynamic succession, as before. And following Groenendijk (2003), questions will refine the input partition by eliminating pairs \(\{(w, f), (w', g)\}\) in \(C\), according to whether \((w, f)\) and \((w', g)\) define different possible answers. Whether they do this or not is determined by whether the \([.]_5\)-semantics of the question transforms \((w, f)\) and \((w, g)\) into the same set of true answers, or not. These principles for defining \([.]_m\) lead to Definition 3—we will see shortly how this semantics is extended to SDRS-formulae that feature rhetorical relations.
Definition 3  The Semantics \( [ \cdot ]_m \) of \( \mathcal{L}_{basic} \)

Let \( M = \langle D, W, I \rangle \) be a model, and let \( C, C' \subseteq (W \times F)^2 \). Then:

(i) \( C[P(x_1, \ldots, x_n)]^M_m C' \) iff 
\[
C' = \{ ((w, f), (w', g')) \in C : (w, f)[P(x_1, \ldots, x_n)]^M_m (w, f) \text{ and } (w', g)[P(x_1, \ldots, x_n)]^M_m (w', g) \}
\]

(ii) \( C[\exists x]^M_m C' \) iff 
\[
C' = \{ ((w, f'), (w', g')) : ((w, f), (w', g)) \in C, (w, f)[\exists x]^M_m (w, f') \text{ and } (w', g)[\exists x]^M_m (w', g') \}
\]

(iii) \( C[\phi \land \psi]^M_m C' \) iff \( C[\phi]^M_m \circ [\psi]^M_m C' \).

(iv) \( C[-\phi]^M_m C' \) iff 
\[
C' = \{ ((w, f), (w', g')) : ((w, f), (w', g)) \in C, (w, f)[-\phi]^M_m (w, f) \text{ and } (w', g)[-\phi]^M_m (w', g) \}
\]

(v) \( C[\delta\phi]^M_m C' \) iff 
\[
C' = \{ ((w, f), (w', g')) : ((w, f), (w', g)) \in C \text{ and } (w, f)[\delta\phi]^M_m (w', f') \text{ and } (w', g)[\delta\phi]^M_m (w', g') \}
\]

(vi) \( C[\lambda x_1 \ldots x_n \phi]^M_m C' \) iff 
\[
C' = \{ ((w, f), (w', g)) \in C : \forall f' \text{ st } \text{dom}(f') = \text{dom}(f) \cup \{x_1, \ldots, x_n\} \text{ and } f \subseteq f', \exists g' \text{ st } \text{dom}(g') = \text{dom}(g) \cup \{x_1, \ldots, x_n\} \text{ and } g \subseteq g', \text{ and } f'(x_i) = g'(x_i), 1 \leq i \leq n \text{ and } \exists (w'', k), (w''', l) \text{ st } (w, f')[\phi]^M_m (w'', k) \leftrightarrow (w', g')[\phi]^M_m (w''', l) \text{ and conversely: } \forall g' \text{ st } \text{dom}(g') = \text{dom}(g) \cup \{x_1, \ldots, x_n\} \text{ and } g \subseteq g', \exists f' \text{ st } \text{dom}(f') = \text{dom}(f) \cup \{x_1, \ldots, x_n\} \text{ and } f \subseteq f', \text{ and } f'(x_i) = g'(x_i), 1 \leq i \leq n \text{ and } \exists (w'', k), (w''', l) \text{ st } (w, f')[\phi]^M_m (w'', k) \leftrightarrow (w', g')[\phi]^M_m (w''', l) \}
\]

The CCPs (6) and (7) of rhetorical relations lift immediately to these new contexts of evaluation; so \( C', C'' \subseteq (W \times F)^2 \) in these definitions. But we can now take advantage of the uniform contexts of evaluation for propositions and questions. As promised in Section 2.1, rhetorical connections among questions can be simplified. Unlike the \( [\cdot]_S \)-semantics from Asher and Lascarides (2003), questions in the \( [\cdot]_m \)-semantics can be arguments to veridical relations such as Elaboration. So the SDRS representing the turn (2)e, as shown in Table 3, invokes an Elaboration on labels for questions. Thus the reporter is committed to the issues raised by both questions, and the second question can be paraphrased in this context as So is it correct that Senator Coleman’s friend has not bought these suits for him?

Further examples of rhetorical relations involving questions from Asher and Lascarides (2003) are QAP (Question Answer Pair) and Q-Elab mentioned earlier. We start with the semantics of QAP. The semantics of questions in Definition 3, following Groenendijk’s (2003), assumes that a direct answer to a question is an exhaustive answer. But
in reality, the demands on answerhood are not so stringent during dialogue interpretation (Ginzburg, 1995): a question can be resolved to the questioner’s satisfaction without the answer being exhaustive. We reflect this in our semantics of QAP—we make it match the constraints on specificity for answerhood that we assumed for this relation in our earlier work.

Technically, we achieve this by introducing a predicate symbol \( \text{Answer} \) between a question and a proposition. \( \text{Answer}(q, p) \) is a test on the input context, but the test may be passed even if \( p \) is not an exhaustive answer (and so fails to exclude all but one class from the partition created by \( q \)). In essence, as in Asher and Lascarides (2003), \( p \) must identify \textit{de re} values for \( q \)’s \textit{wh}-elements, or entail that no such elements exist. So it is a stronger constraint on answerhood than partial answerhood but not as strong a constraint as exhaustive answerhood. For instance, \( \text{Answer}(q, p) \) will be true when \( q \) is \textit{Who talked?} and \( p \) is \textit{Mary talked}: this is not an exhaustive answer (people other than Mary may have talked) and accordingly fails to eliminate all but one class from the partition created by \( q \). The formal definition of the predicate \( \text{Answer} \) is as follows:

\[
\bullet C[\text{Answer}(?\lambda x_1, \ldots, x_n \phi, p)]_m C' \text{ iff } \\
1 \ C = C' \text{; and } \\
2 \ \forall C'' \text{ such that } C[?\lambda x_1, \ldots, x_n \phi]_m C'', \text{ there is a } C''' \text{ such that } C''[p]_m C''' \text{ and either } \\
\quad - \ \exists a_1, \ldots, a_n \in \Delta \text{ such that for all } (w, f) \in \bigcup C''', \\
\quad \exists (w', g) \text{ st } (w, f \frac{a_1}{x_1}, \ldots, \frac{a_n}{x_n})[\phi]_S(w', g) \text{ or } \\
\quad - \ \forall a_1, \ldots, a_n \in \Delta \text{ and for all } (w, f) \in \bigcup C''', \\
\quad \neg \exists (w', g) \text{ st } (w, f \frac{a_1}{x_1}, \ldots, \frac{a_n}{x_n})[\phi]_S(w', g)
\]

The semantics of QAP is then defined in terms of \( \text{Answer} \), to reflect the intuition that non-exhaustive answers can play a rhetorical role in a dialogue of being a sufficiently specific answer:

\[
C[QAP(\alpha, \beta)]_m C' \text{ iff } C[K_\alpha \land \text{Answer}(K_\alpha, K_\beta) \land K_\beta]_m C'
\]

In words, \( QAP(\alpha, \beta) \) partitions its input state \( C \) into one that distinguishes among the possible exhaustive answers to the question \( K_\alpha \), the resulting partition satisfies the test imposed by \( \text{Answer}(K_\alpha, K_\beta) \)—in other words, updating \( C \) with \( K_\beta \) would yield an output state that identifies \textit{de re} values to \( K_\alpha \)’s \textit{wh}-elements, or it identifies that there no such values exist—and finally the context is updated by \( K_\beta \), and hence the output context \( C' \) has resolved (in the rhetorical sense, if not in the literal sense) the question \( K_\alpha \). The original definition of \( QAP(\alpha, \beta) \) from Asher and Lascarides (2003) was not veridical on \( \alpha \); now it is, reflecting the fact that answering a question entails acceptance of the issues raised by the question. Similarly, whereas the original definition of \( Q-\text{Elab} \) from Asher and Lascarides (2003) was non-veridical our revised definition makes it veridical. In other words, its CCP is defined by (6), with meaning postulates on \( \phi_{Q-\text{Elab}(\alpha, \beta)} \) constraining \( K_\beta \) so that it helps achieve the intentions behind \( \alpha \) (formal details are omitted here, but see Asher and Lascarides (2003)). We can similarly define a univocal semantics
for Result, Result*, Elaboration, Commentary and Commentary*, regardless of whether their terms are questions or assertions.

We have now defined the $\mathcal{J}_m$-semantics for all SDRS-formulae. The semantics of an SDRS is the semantics of the content of its unique root label. In other words, for an SDRS $S$ with root label $\pi_0$, $C[S]_mC'$ iff $C[K_{\pi_0}]_mC'$. The semantics $\mathcal{J}_d$ of a DSDRS is then defined in terms of $\mathcal{J}_m$ as described in Section 2: the CCP of a dialogue turn is given in (4); the entailment relation it engenders in (5); and the CCP of an entire DSDRS is that of its last turn.

The illocutionary contributions of speech acts are encoded in the semantics of DSDRSs, as a part of the agents’ commitments. And thus our definition of acceptance as joint entailment on those commitments enables implicit acceptance. With our new semantics of SDRSs, we can now make the right predictions about acceptance and rejection of questions, as well as acceptance and rejection of assertions. For instance, with the logical form in Table 2 for dialogue (1), our revised semantics of $Q$-Elab as a veridical relation ensures that $B$ accepts $A$’s question (1)a. In contrast, $S$ does not accept $R$’s questions in dialogue (2), given its logical form in Table 3; nor does $R$ accept $S$’s assertions.

4 Conclusion

This paper presents a dynamic model theory for questions that fully supports a theory of acceptance and rejection for questions and assertions. Following GAM (Traum, 1994), it models acceptance as shared public commitment. However, unlike any prior formally precise theory of dialogue of which we are aware, it is able to represent implicit acceptance, and it also analyses commitments to questions and mutual acceptance of the issues raised by questions.

A crucial ingredient in our account was the use of relational speech acts, and the logical relationships among their commitments. By ‘lifting’ the distributive dynamic semantics from Asher and Lascarides (2003) to a collective semantics in the style of Groenendijk (2003), we were able to maintain a uniform model of acceptance regardless of whether the speakers utter indicatives or interrogatives.

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References


Building Event-Based *Ad Hoc* Properties: 
On the Interpretation of Adjectival Passives

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Abstract
The paper develops a new perspective on the semantics and pragmatics of adjectival passives that focuses on their characteristic context dependency. Adjectival passives are analyzed as a flexible grammatical means of creating a potentially new *ad hoc* property based on the verbal event by which the subject referent is categorized according to contextually salient goals. The post state vs. target state ambiguity of adjectival passives is accounted for by deriving the two readings from a semantically underspecified representation that requires the pragmatic machinery to infer a suitable contextual instantiation.

1 Introduction

The aim of this paper is to develop a new perspective on the semantics and pragmatics of adjectival passives that accounts properly for the impact the context has on their formation and interpretation. There are two ways in which the context comes into play when dealing with adjectival passives. First, context appears to greatly influence which verbs get to build adjectival passives. Typical cases of adjectival passives discussed in the literature are based on transitive resultative verbs like *to close* or *to submit*, i.e. verbs with a lexically specified result state; see e.g. the German sentences in (1).¹

(1) a. Die Schublade war geschlossen.
    The drawer was closed.

b. Das Manuskript ist eingereicht.
    The manuscript is submitted.

¹ Note that (1) only has an adjectival passive reading; the verbal passive is built with the auxiliary *werden* in German; see below.
Kratzer (2000) briefly mentions the case of activity verbs like *streicheln* ‘to pet’. These verbs do not have a designated result state and they seem to resist adjectival passive formation. A sentence like (2) sounds odd out of the blue.

(2) ? Die Katze ist gestreichelt.
The cat is petted.

Yet under certain contextual conditions adjectival passives may also be built with activity verbs. In particular, sentences like (2) are fine if the context supports what Kratzer (2000: 4) calls a “job is done” interpretation; see also Rapp (1998: 243f), Maienborn (2007a). A natural setting for such a “job is done” interpretation for (2) is given in (2’).

(2’) Anna hat ihre Nachbarspflichten erfüllt: Der Briefkasten ist geleert, die Blumen sind gegossen und die Katze ist gestreichelt.
Anna has her neighbor-duties fulfilled: The mailbox is emptied, the flowers are watered, and the cat is petted.

‘Anna has done her neighborly duties: the mailbox is emptied, the flowers are watered and the cat is petted.’

Judgments are also improved if the subject triggers a figurative use of the participle as in (2’); cf. Gese et al. (2009).

(2”) Meine Seele ist gestreichelt.
My soul is petted.

‘My soul is caressed.’

Thus, in light of perfectly natural variants like (2’) and (2”), the adjectival passive formation of activity verbs such as *streicheln* ‘to pet’ should not be ruled out as ungrammatical. The same holds true for other seemingly ill-formed cases, such as stative verbs. According to Kratzer (2000: 5) stative verbs like *wissen* ‘to know’ are categorically excluded from the adjectival passive formation; sentence (3) is judged ungrammatical by Kratzer. Yet in a contrastive setting like the one in (4), where it is at issue whether an answer has been given on the basis of firm knowledge or by guessing, sentence (3) is perfectly fine and by no means deviant.

(3) Die Antwort ist gewusst.
The answer is known.

(4) Ist die Antwort gewusst oder geraten?
Is the answer known or guessed?

Thus the context plays an important role in the formation and admissibility of adjectival passives. Moreover – and this is the second way how context comes into
play – adjectival passives have two readings, depending on their contextual environment: a “post state reading” as indicated by the continuation in (5a) and a “target state reading” illustrated in (5b).

(5) Das Manuskript ist eingereicht …
    The manuscript is submitted …
    a. … jetzt können wir uns an den Projektantrag machen post state reading
       … let’s turn to the project proposal now
    b. … aber nicht angenommen / veröffentlicht / … target state reading
       … but not accepted / published / …

Roughly speaking, the post state reading of sentence (5) means that the manuscript is classified as being in the post state of a submitting event, while the target state reading of (5) expresses that the manuscript belongs to the class of submitted papers, rather than being, e.g., accepted or published or rejected. A first indication for the existence of these two readings can be found in Brandt (1982: 31) and has been independently observed and elaborated by Kratzer (2000). Kratzer’s account will be presented in more detail below.

This provides a first overview of the kind of data that will be discussed in the present paper. In the following I will argue that adjectival passives are subject to a particular kind of contextual variance resulting from the interplay between grammar and pragmatics. More specifically, adjectival passives will be analyzed as a flexible grammatical means of creating a potentially new ad hoc property based on the verbal event by which the subject referent is categorized according to contextually salient goals. Under this view post state and target state readings of adjectival passives will turn out to be contextual specifications of a common, more abstract semantic representation.

The paper is organized as follows: Section 2 summarizes the relevant facts and assumptions concerning adjectival passives that constitute the background for the present analysis. Section 3 develops the idea of event-based ad hoc properties as the core notion behind adjectival passives. This leads to the formulation of an underspecified semantics for adjectival passives in section 4, which in turn provides the starting point for deriving post state and target state readings of adjectival passives by means of contextual enrichment in the final section 5.

2 Background

Let’s start with some introductory remarks on adjectival passives. In the literature on passives it has widely been observed that many languages display two kinds of

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2 Kratzer (2000) uses the term “resultant state reading” instead of the term “post state reading”, which I will use here. She also has a somewhat narrower understanding of the target state reading in mind, restricting it to only those target states that are reversible (as indicated by the admissibility of the modifier immer noch ‘still’).
passives: an eventive, or verbal, passive and a so-called “stative”, or “adjectival”, passive; see the overview in Emonds (2006). English does not mark this difference overtly – both verbal and adjectival passives are expressed by an -en/-ed participle in combination with a form of to be. Thus, a sentence like (6) is ambiguous between an eventive and a stative reading and can only be disambiguated by the linguistic or extralinguistic context; see (6a) vs. (6b). The manner adverbial quietly and the agent phrase by the thief in (6a) highlight the verbal passive’s eventive reading whereas the durative adverbial for years in (6b) selects for the adjectival passive’s stative reading.

(6) The drawer was closed. adjectival or verbal passive
   a. The drawer was quietly closed by the thief. verbal passive
   b. The drawer was closed for years. adjectival passive

That is, the same form to be is used both in the verbal and in the adjectival passive. This makes it difficult to tease apart verbal and adjectival passives in English. In a language like German the situation is more transparent, because verbal and adjectival passives are expressed by different means. The verbal passive is built by combining an -en/-t participle with the passive auxiliary werden (‘become’); cf. (7).3 The adjectival passive is formed by using sein (‘be’) instead; cf. (8).

(7) Die Schublade wurde geschlossen. verbal passive
    The drawer became closed
    ‘The drawer was closed.’
      The drawer became quietly by the thief closed
      ‘The drawer was quietly closed by the thief.’
   b. *Die Schublade wurde jahrelang geschlossen.
      The drawer became for years closed

(8) Die Schublade war geschlossen. adjectival passive
    The drawer was closed
    ‘The drawer was closed.’
      The drawer was quietly by the thief closed
   b. Die Schublade war jahrelang geschlossen.
      The drawer was for years closed
      ‘The drawer was closed for years.’

3 The ungrammatical sentence (7b) could only be rescued by an iterative reinterpretation of the verbal expression.
Thus, a sentence like (8) can only receive an adjectival passive analysis. Due to their formal difference there is no danger of mixing up adjectival and verbal passives in German. This makes German particularly suitable for studying adjectival passives.

It should be stressed that the adjectival passive formation is a very productive process, at least in German. Adjectival passives coexist with primary adjectives as in (9); forms such as *geleert sein* (‘to be emptied’), *geöffnet sein* (‘to be opened’) are not blocked by the respective primary adjective but are completely regular.

\[(9)\]
\[
a. \text{Die Schublade ist geöffnet / offen}
\]
\[
The drawer is opened / open
\]
\[
b. \text{Die Schublade ist geleert / leer}
\]
\[
The drawer is emptied / empty
\]

Further illustration of the productivity of the adjectival passive formation in German is given in (10). A manuscript may be submitted, accepted, cited, reviewed, rejected etc. as in (10a). One may also use a sentence like (10b) to express that a certain crisis is an artefact that was brought about by the actions of some protagonists (rather than being the result of a natural development).

\[(10)\]
\[
a. \text{Das Manuskript ist eingereicht / akzeptiert / zitiert / begutachtet ...}
\]
\[
The manuscript is submitted / accepted / cited / reviewed …
\]
\[
b. \text{Die Krise ist gemacht.}
\]
\[
The crisis is made
\]

That is, with the exception of a very small set of verbs for which the adjectival passive formation is categorically ruled out (e.g. weather verbs, true reflexives, certain statives like *kosten* (‘to cost’)), almost any verb may form an adjectival passive in German; see Maienborn (2007a) for details and Gese et al. (2008) for a thorough discussion of the particularly interesting case of unaccusatives.

The last remark to be made here concerns the underlying structure of adjectival passives. Nowadays there is wide agreement among linguists that adjectival passives, are to be seen as combinations of the copula *sein* / *to be* with an adjectivized verbal participle (e.g., Kratzer 1994, 2000; Rapp 1997, 1998; von Stechow 1998; Maienborn 2007a; Gese et al. 2008) rather than some analytic verb form. Following Lieber (1980) the adjectival participle is derived from its verbal counterpart via zero-affixation:

\[(11)\]
\[
\text{Die Schublade ist geschlossen adjectival analysis}
\]
\[
\text{COP [AP [A [VPART geschlossen] ø ]]}
\]

(11) provides the structural basis for the following semantic analysis.\(^4\)

---

\(^4\) Stolterfoht et al. (2008) provide further psycholinguistic evidence for the structural analysis given in (11). In a self-paced reading study we found that participles in adjectival passives require more processing effort than those in verbal passives. These results support the assumption that adjectival passives rely on an additional conversion process of the verbal participle.
3 Event-based ad hoc properties

While the view that adjectival passives are in fact combinations of the copula sein / to be with an adjectivized participle has become widely accepted, the implications that such a view on the structure of adjectival passives has for their interpretation haven’t been explored up to now. This is what I want to pursue here. If adjectival passives are to be seen as a special instance of the form ‘copula plus adjectival predicate’, we expect their meaning to follow the general pattern of copula expressions.

For our purposes it suffices to say that a copula sentence ascribes to the subject referent the property given by the predicate. For instance, sentence (12) expresses that the manuscript has the property of being new. That’s fairly simple; see Maienborn (2003, 2005a, 2005b, 2007b) and the literature discussed therein for a more thorough consideration of the semantics of the copula.

(12) The manuscript is new.

So the question is whether we can view adjectival passives along these lines and analyze them as ascribing a certain property to their subject referent. What would be a plausible candidate for such a property? I propose that adjectival passives assign a pragmatically salient ad hoc property to the subject referent. This ad hoc property is conceived of as resulting from the event referred to by the verbal participle. That is, while a standard copula sentence with an adjectival base predicate assigns to the subject referent a lexically coded property, which has a fixed place in the subject referent’s property space, adjectival passives are a grammatically supplied means of creating ad hoc potentially new, event-based properties, whose exact import, and therefore the place they occupy in the subject referent’s property space, is more or less shaped by the context and by our contextually available world knowledge.

What do I mean by event-based ad hoc properties? Let’s take (13) for an illustration.

(13) Das Manuskript ist eingereicht.
The manuscript is submitted

Sentence (13) does not just express that the manuscript is in some result state of having been submitted; it tells us more. In fact, we may interpret (13) as a statement about the quality of the manuscript. Our background knowledge as (linguistic) scientific community provides us with rich information about possible stages and gradings for scientific papers. We know that – at least when it comes to some assessment – a manuscript that is submitted is better than a manuscript that isn’t finished yet or a manuscript that is published in some less prestigious place. But of course it would be better if our manuscript were accepted or even published in a high impact journal.
Adding an event-related modifier as in (14) makes the differentiation of potential properties for the subject referent even finer.\(^5\)

\begin{align*}
\text{(14) a. } & \text{Das Manuskript ist bei } Nature \text{ eingereicht.} \\
& \text{The manuscript is to } Nature \text{ submitted} \\
\text{b. } & \text{Das Manuskript ist von Chomsky zitiert.} \\
& \text{The manuscript is by Chomsky cited} \\
\text{c. } & \text{Das Manuskript ist in einer Nacht geschrieben.} \\
& \text{The manuscript is in one night written}
\end{align*}

The modifiers in (14) activate bits of background knowledge which then trigger certain inferences about the kind of manuscript we are dealing with. For instance, from (14a) we may infer, given the reputation of the Journal *Nature*, that the manuscript is of very high quality – at least that is what the author believes. To be cited by Chomsky, as expressed in (14b), is kind of an accolade in generative linguistics. And a manuscript that is written in one night (14c) could be either ingenious or awfully sloppy.

As these examples already show the inferences drawn in a given context may vary considerably and depend largely on our particular background knowledge and attitudes. Providing a full account of this kind of contextual variance is not our job as linguists. However, what is crucial is that the adjectival passive requires us to draw some such inference by which we derive a certain property that is ascribed to the subject referent in the given context. This requirement is part of the semantics of adjectival passives.

The *ad hoc* nature of the property expressed by adjectival passives becomes particularly evident in adjectival compounds such as (15).

\begin{align*}
\text{(15) a. } & \text{Das iPhone ist PIN-gesichert.} \\
& \text{The iPhone is PIN-secured} \\
\text{b. } & \text{Alle Mitglieder des Berliner Senats sind stasi-überprüft.} \\
& \text{All members of the Berlin senate are stasi-checked} \\
\text{c. } & \text{Die Realität ist heute weitgehend Diana-bereinigt.} \\
& \text{The reality is today largely Diana-purged} \\
& \text{(Spiegel-online 18.07.2007)} \quad \text{\textsuperscript{6}}
\end{align*}

\(^5\) The ability of adjectival passives to combine with typical verbal modifiers like agent phrases, instrumentals and locatives plays a prominent role in the current discussion. Kratzer (1994, 2000) proposes to account for data such as (14) by assuming that the adjectival ø-affix may attach at the lexical level as well as at the phrasal level. In the latter case adjectivization applies to a whole VP including verbal modifiers. Kratzer’s solution has been taken up and developed further by several authors; cf. e.g. (Rapp 1997, 1998), von Stechow (1998), Anagnostopoulou (2003), Embick (2004), Alexiadou & Anagnostopoulou (2007). I don’t have place to discuss this issue here, but see Maienborn (2007a) for arguments against using phrasal adjectivization to account for the combination of adjectival passives with verbal modifiers and an alternative solution that assumes only lexical adjectivization of the verbal participle. In short, I propose to analyze the modifiers in (14) as being integrated into the verbal complex (in the sense of Jacobs 1993, 1999), thus building a complex predicate.

\(^6\) From a report about the 10\textsuperscript{th} anniversary of Princess Di’s death.
d. Ich hatte Sorge wie der Japaner das Oktoberfest finden würde, aber es stellte sich heraus, dass er schwedentrainiert war. (overheard on 11/2007)
‘I was worried about what the Japanese guy would think about the Oktoberfest, but it turned out that he was Sweden-trained.’

Predicatively used compounds such as \textit{PIN-gesichert} (‘PIN-secured’) or \textit{stasi-überprüft} (‘stasi-checked’) are widespread. Besides more or less lexicalized forms such compounds are also readily built “online”; cf. the occasional compounds \textit{Diana-be-reinigt} (roughly: ‘Diana-purged’) or \textit{schwedentrainiert} (‘Sweden-trained’) in (15c/d). E.g., the intended interpretation of \textit{schwedentrainiert} in (15d) is that the Japanese referred to was “trained” in Sweden and thus got used to drinking (lots of) alcohol.

Both the modifier data in (14) and the compound data in (15) provide further support for the claim that adjectival passives are a means of creating more or less \textit{ad hoc} possibly complex adjectival predicate by which the subject referent is assigned a certain property that is shaped by contextually salient knowledge, attitudes and goals.

The view of adjectival passives as expressing \textit{ad hoc} properties is inspired by Barsalou’s (1983, 1991, 1992, 2005) notion of \textit{ad hoc} categories such as ‘things to take on a camping trip’. These are goal-derived categories that are created spontaneously for use in more or less specialized contexts. Under this perspective adjectival passives may be seen as a means to extend and contextualize a concept’s property space with respect to contextually salient goals.

To sum up, there is more to the meaning of adjectival passives than some kind of aspectual shift between the verb’s event referent and some result state. I propose that adjectival passives are, in fact, nothing but a special case of a copula sentence. By taking a (possibly complex) verbal predicate and converting it into an adjective which then is combined with the copula, the subject referent is assigned a certain property that is linked to the verb’s event argument. The crucial point is that this link may be mediated more or less heavily by context and world knowledge. This accounts for the characteristic \textit{ad hoc} nature of adjectival passives.

(16) a. Das Manuskript ist von Chomsky zitiert.
The manuscript is by Chomsky cited

b. Das Manuskript ist von Chomsky zitiert worden.
The manuscript has by Chomsky cited been

With an adjectival passive such as (16a) we classify the manuscript and assign it a certain place within the concept’s property space, e.g. as being recommended reading for the generative linguistics community. The perfect tense verbal passive counterpart in (16b) expresses that there is a post state of an event of citing the manuscript by Chomsky, and nothing more. We may go on and draw some inferences here too, but there is no need to do so. Adjectival passives, on the other hand, force us to derive a suitable \textit{ad hoc} property. A semantics for adjectival passives should take account of this subtle difference.
4 An underspecified semantics for adjectival passives

In the following I will sketch a proposal for a formal semantic account of adjectival passives that implements the analysis developed above. First I will briefly summarize the very influential proposal by Kratzer, which set the frame for a series of further developments and variants (e.g. von Stechow 1998, Anagnostopoulou 2003, Embick 2004, Alexiadou & Anagnostopoulou 2007).

Kratzer (2000) proposes to assume two zero-affixes by which the verbal participle (whose semantics is identical to that of the verbal stem) is converted into an adjective. These so-called “stativizers” are intended to account for the two readings of adjectival passives. The semantics of the post (or resultant) state zero-affix is given in (17a), its target state variant is given in (17b).

(17) a. Post state Ø-affix: \( \lambda P \lambda t \exists e [P(e) \land \tau(e) < t] \) Kratzer (2000: 12)
b. Target state Ø-affix: \( \lambda R \lambda s \exists e [R(s)(e)] \) Kratzer (2000: 8)

The examples in (18) and (19) illustrate the result of applying these affixes to a verbal form.\(^7\)

(18) **Post state reading:** Kratzer (2000: 12)
a. Das Theorem ist bewiesen.
The theorem is proven
b. beweis-: \( \lambda x \lambda e [prove(x)(e)] \)
c. [ IP das Theorem bewiesen sei]: \( \lambda t \exists e [prove \text{ (the theorem)}(e) \land \tau(e) < t] \)

(19) **Target state reading:** Kratzer (2000: 8)
a. Der Reifen ist aufgepumpt.
The tire is pumped-up
b. aufpump-: \( \lambda x \lambda s \lambda e [\text{pump} (e) \land \text{inflated} (x)(s) \land \text{cause} (s)(e)] \)
c. [ IP der Reifen aufgepumpt sei]: \( \lambda s \exists e [\text{pump} (e) \land \text{inflated} \text{ (the tire)}(s) \land \text{cause}(s)(e)] \)

Assuming the zero-affix in (17a) yields a semantic analysis of the post state reading according to which an adjectival passive expresses a resultant state (given over times \( t \)) that starts with the culmination of the verb’s event and holds forever after; see Parsons (1990: 234) for this view on resultant states. Kratzer’s target state affix in (17b) may only apply to a subgroup of resultative verbs, more specifically those verbs that specify a characteristic (and in principle reversible) target state that is compositionally accessible via the verb’s argument structure; see e.g. the lexical entry for the verb

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\(^7\) For the time being I neglect further complications in connection with Kratzer’s suggestion that these affixes may apply both at the lexical and the phrasal level (see footnote 5).
"aufpumpen" ('to pump up') in (19b). According to this analysis the target state reading of an adjectival passive expresses a lexically specified target state that is caused by the verb's event.

These are the aspects of Kratzer's proposal that are relevant for our present purposes in a nutshell. Under the perspective on adjectival passives developed above this analysis has three shortcomings. First, Kratzer analyzes the adjectival passive ambiguity as a case of lexical homonymy. Her post state stativizer in (17a) and the target state stativizer in (17b) have nothing in common (apart from the existential binding of the verb’s event argument). This does not seem to me a particularly attractive feature of Kratzer’s account given the apparent relatedness of the two readings. Second, the application of the stativizers is determined exclusively by the verb’s argument structure. The target state reading is only available for the lexical subgroup of target state verbs. This is in conflict with the characteristic contextual flexibility of adjectival passives observed above. The previous discussion of the data has shown that the target state reading of adjectival passives is much more broadly available than Kratzer’s lexical account predicts. In fact, with a little contextual help both readings are available for nearly any verb. And third, Kratzer’s account reduces the semantic contribution of the adjectival zero-affixes to a merely aspectual shift from the verbal event to some subsequent state (either post or target state). This ignores the subtle but crucial difference between adjectival passives and perfect tense; see the discussion of (16).

In sum, all the ingredients of Kratzer’s account of the meaning of adjectival passives are to be found either in the lexicon or in the grammar. There is no particular place for a systematic contextual import. This does not fit very well with the empirical evidence presented above.

What would a more balanced division of labor between grammar and pragmatics look like? As for the grammar, I want to propose that the meaning of adjectival passives should be accounted for by assuming a unique adjectival zero-affix. This affix is semantically underspecified in two respects. First, it does not fully determine what kind of property is assigned to the subject referent. And, secondly, it is underspecified with respect to the post state / target state ambiguity of adjectival passives. A respective semantic representation for a zero-affix that turns a verbal into an adjectival participle is given in (20).

(20) Adjectival Ø-affix: \[ \lambda P \lambda x \lambda s \exists e [s: Q(x) \& \text{result (e, s)} \& P(e)] \]

According to (20) the adjectival affix introduces a free variable Q for the property that holds for the subject referent x in a state s. Q is further restricted as resulting from the verbal event e. The grammar does not supply any more information than that about the actual kind of property. An illustration is given in (22). For comparison see the representation of a standard copula sentence with an adjectival base predicate in (21).

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8 Recall that Kratzer’s conception of the target state reading is more narrow than the one I advocate here (see footnote 2)
9 Sentence (19a) may have an additional post state reading besides that.
As for the semantics of the copula, I have argued in Maienborn (2005a, 2007b) that copula constructions and other stative verbs differ fundamentally from Davidsonian event and state expressions. In order to account for this difference I introduced a new ontological sort of so-called “Kimian states” (or K-states) that supplements the ontological sort of Davidsonian eventualities (which also include Davidsonian states). K-states are to be understood as reifications for the exemplification of a property Q at a holder x and a time t. From this it follows that K-states are ontologically poorer and more abstract than Davidsonian eventualities; see Maienborn (2005a, 2007b) for details. I’ll come back to this issue below.

Turning back to our adjectival passives, a comparison of the semantic structures given in (21) and (22) shows that the semantics of the adjectival zero-affix laid out in (20) leads to an analysis of adjectival passives that follows the pattern of regular copula sentences. Adjectival passives only differ from adjectival base predicates in that they express an internally more complex and semantically underspecified property. For the adjectival passive to be interpretable, the free variable Q must be given a suitable value by the context.

5 Deriving post state and target state readings

The semantic analysis advocated in the previous section takes adjectival passives to express a semantically underspecified, event-based ad hoc property. The task of pragmatics is to legitimate this ad hoc property in a given context. More specifically, pragmatics must provide a contextually suitable value for the free variable Q, and it must justify the choice of an ad hoc formation instead of a pre-established, lexically coded property. This will lead to the post state / target state differentiation.

I will not present a formal account for the pragmatics in this paper but will only point towards the basic idea. In searching for a value for the free variable Q, the best/most economic instantiation for it is the one that gets by with the fewest contextually not licensed additional assumptions. If the conceptual knowledge associated with the verb’s event referent happens to already specify a resulting property, this will of course be the best choice for Q. In this case, there is no need to draw further inferences and derive more remote ad hoc property candidates – unless the context explicitly forces us to.

This explains why virtually no pragmatic effort is needed for interpreting adjectival passives in the case of resultative verbs. These verbs already specify a result state within their lexical entry. Thus Q may simply be identified with the property
introduced at the lexical level. Non-resultative verbs will need more contextual support to derive a suitable value for Q and to localize Q within the category’s property space. That is, while the pragmatic effort needed to derive a contextually suitable value for Q may vary considerably, sometimes being completely predictable from the verb’s lexical semantics and sometimes relying heavily on context and world knowledge, the basic mechanism is the same.

A pragmatic justification for favoring an *ad hoc* formation over a lexically coded property follows from independent pragmatic economy principles (e.g. Blutner 1998, 2000; Levinson 2000; see also Ackerman & Goldberg 1996). Using an *ad hoc* property will only be pragmatically licensed if the context supports a salient alternative. That is, for an adjectival passive to be interpretable, the context must provide a contrasting alternative K-state s’.

As I indicated above, K-states are ontologically sparse entities and therefore offer few possibilities for establishing suitable alternatives. There are basically two options. This gives us the two readings of adjectival passives. A contextually salient contrasting state s’ may differ from s with respect to either the temporal or the qualitative dimension. In the first case the context provides a salient alternative state s’ that preceeds s and in which x does not have the property Q. This corresponds to the adjectival passive’s post state reading; see (23a). In the second case, s’ exemplifies a contextually salient property Q’ that is distinct from Q; see (23b).

(23) Das Manuskript ist eingereicht.

\[ \exists s [s \models Q \land \text{result} \land \text{submit}] \]

a. **Post state reading:**

\[ \ldots \land \text{contrast} \land (s, s') \land \neg Q(x) \land s' < s \]

b. **Target state reading:**

\[ \ldots \land \text{contrast} \land (s, s') \land s': Q'(x) \]

Whether the contrasting state s’ is construed along the temporal or the qualitative dimension affects the truth conditions of the adjectival passive. This is shown by the fact that we can simultaneously affirm and deny a particular state of affairs; see Zwicky & Sadock (1975), Kennedy (2009). In a context where an author finally succeeded in finishing a manuscript and submitted it to a journal but already received the sad note that the paper was rejected, he could answer (24) when asked about the manuscript.

(24) Das Manuskript ist zwar eingereicht, aber es ist nicht eingereicht, sondern abgelehnt.

The present proposal accounts for this post state / target state ambiguity by letting s be contextually determined relative to a salient contrasting alternative s’.
Finally, Kratzer’s “job is done” reading by which the adjectival passive of, e.g., an activity verb like streicheln (‘to pet’) can be “rescued” (cf. (2’) repeated in (25) below) turns out to be a specific instance of the post state reading.

(25) Anna hat ihre Nachbarspflichten erfüllt: Der Briefkasten ist geleert, die Blumen sind gegossen und die Katze ist gestreichelt. ‘Anna has done her neighborly duties: the mailbox is emptied, the flowers are watered, and the cat is petted.’

The particular context given in (25) supports an ad hoc categorization of cats into two contrasting sets, cats that still need to be petted and cats that have already been petted. With the adjectival passive sentence The cat is petted the subject referent is assigned the property of belonging to the second class.

The semantic and pragmatic analysis achieves the goals laid out in the beginning: First, it takes seriously the structural insights into the nature of adjectival passives and exploits them for their interpretation in taking adjectival passives to be a special instance of copula sentences. And, secondly, it accounts for the characteristic context dependency and ad hoc feel of adjectival passives by introducing a free variable at the semantic level that requires the pragmatic machinery to infer a suitable contextual instantiation. All in all this yields a more balanced division of labor between grammar and pragmatics in accordance with the empirical facts.

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References


On *Wh*-Islands

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Abstract

This paper argues that *wh*-islands are unacceptable because they cannot be given a complete (exhaustive) answer. In the case of degree questions, the complete answer expresses a contradiction given the assumption that degree questions range over intervals. In the case of manner questions the problem arose from the fact that a complete answer to these questions is equivalent to a sentence with an embedded declarative, which is either a violation of the principle of Maximize Presupposition!, as in the case of question embedding predicates such as *know*, or simply incompatible with the meaning of the question embedding predicate, which is argued to be the case with predicates such as *wonder*.

1 Introduction

An interrogative complement clause creates an environment of which *wh*-words ranging over individuals can move out\(^1\), but not *wh*-words ranging over degree or manners:

\begin{align*}
1. & \quad \text{a. } \textit{Which problem do you wonder how to solve?} \\
2. & \quad \text{b. } \textit{How do you know which problem to solve?} \\
3. & \quad \text{c. } \textit{How high do you wonder who to lift?} \\
4. & \quad \text{a. } \textit{Which problem do you know whether to solve?} \\
5. & \quad \text{b. } \textit{How do you wonder whether to solve the problem?} \\
6. & \quad \text{c. } \textit{How tall do you know whether to be?}
\end{align*}

\(^{1}\) There is significant crosslinguistic variation with respect to these facts: E.g. in English and Hungarian extraction of *wh*-words over individuals is indeed markedly better from their degree and manner counterparts, French e.g. however prohibits the extraction of *wh*-words ranging over individuals as well. I will not address this cross-linguistic difference.
The contrasts exemplified above represent some of the core cases of so-called weak-island violations and have been a major topic in the syntactic literature in the last 20 years or so (cf. Rizzi 1990, Cinque 1990 and subsequent literature). Other examples of paradigmatic weak-island violations include negative islands, factive islands, islands created by certain quantifiers, to name but a few. Interestingly enough, the existing semantic accounts of weak islands, such as Szabolcsi and Zwarts (1993, 1997), Honcoop (1996), Rullmann (1995), Fox and Hackl (2007) concentrate their attention on one or more of these latter types of islands, offering at best a promissory note about the cases of the type of island violations exemplified above. The exception is Cresti (1995), who offers a syntactico-semantic account for wh-islands that arise with degree extraction. This paper presents a new, purely semantic/pragmatic account to wh-islands.

Dayal (1996) has argued that a question presupposes that there is a single most informative true proposition in the Karttunen denotation of the question, i.e. a proposition that entails all the other true answers to the question. This principle has been shown to explain the unacceptability of negative degree islands in Fox and Hackl (2007) and Abrusán and Spector (2008), and also to explain a number of other types of weak islands in Abrusán (2007). In this paper I argue that in the case of wh-islands that are formed by an extraction of a degree-wh phrase, Dayal’s (1996) presupposition can also never be met. As a consequence, any complete answer to these questions will amount to the statement of a contradiction. The reason is that for any proposition p in the question domain, there will be at least two alternatives to p that cannot be denied at the same time. I argue that this maximization failure is predicted if we assume an interval-based semantics of degree constructions (cf. Schwarzschild and Wilkinson 2002, Heim 2006). In the case of manner questions the situation will be slightly different: Although these do have a most informative true answer, however, this answer will always be contextually equivalent to its counterpart with an embedded declarative. Since the answer with the embedded interrogative comes with a vacuous presupposition, while the answer with the embedded declarative has a contentful presupposition, any answer to a question such as the b-examples above will be a violation of the principle of Maximize Presupposition (cf. Heim (1991), Sauerland (2003), Percus (2006), Schlenker (2008)). Thus according to this proposal the compositional semantics and pragmatics of questions supplies everything we need for the explanation of wh-islands in questions, without invoking any further special rules.

A disclaimer is in order at this point: one aspect that I will not discuss in this paper is the role of tense, in other words why is it that the presence of overt tense marking turns these islands into strong islands in many languages? I will assume that this is a consequence of an independent factor that creates strong-islands. Therefore the only thing that I will be concerned with here is the difference that I predict between questions about individuals on the one hand, and questions about manners and degrees on the other hand, independently of the contribution of tense.

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2 The data on tensed constituent wh-complements seems to show a lot of cross-linguistic and cross-speaker variation. E.g. Szabolcsi (2006) reports sentences such as (i) below to be acceptable in Hungarian, but not in English or Dutch for most speakers.

(i) ??Which men did John ask whether Bill invited?
2 Embedded Questions and Exhaustivity

While Groenendijk and Stokhof (1982, 1984) have famously proposed that embedded questions in general should be understood as strongly exhaustive, Heim (1994) and following her Beck and Rullmann (1999), Guerzoni and Sharvit (2004) have argued for a theory that has more flexibility, namely allows for at least some embedded questions to be understood as weakly exhaustive. In this respect, a three-way classification is sometimes assumed (cf. e.g. Guerzoni and Sharvit 2004, Sharvit 1997) according to which predicates such as wonder are always strongly exhaustive\(^3\), predicates belonging to the know-class can be understood as both strongly and weakly exhaustive, while predicates such as be surprised or predict only allow weakly exhaustive readings. At the same time, the weakly exhaustive reading of the verbs belonging to the know-class is rather controversial (cf. Sharvit 1997 for an overview) and therefore in the following discussion I will only use their strongly exhaustive readings.

Which types of question embedding predicates create wh-islands? It seems that wh-islands arise with both the wonder- and the know-type of question embedding predicates.

(3) **Wonder class** predicates (e.g. Wonder, ask, want to know, inquire...)
   a. ?Who does Mary wonder whether to invite?
   b. *How is Mary wondering whether to behave?
   c. *How tall is the magician wondering whether to be?
   d. ?Which problem do you wonder how to solve?
   e. *How do you wonder which problem to solve?
   f. *How high do you wonder who to lift?

(4) **Know-class** predicates (Know, find out, remember, be certain...)
   a. ?Who does Mary know whether to invite?\(^4\)
   b. *How does Mary know whether to behave?
   c. *How tall does Mary know whether to be?
   d. ?Which problem do you know how to solve?
   e. *How do you know which problem to solve?
   f. *How high do you know who to lift?

How about predicates belonging to the surprise class, i.e. the class of weakly exhaustive predicates? Unfortunately, these examples do not offer a good testing ground for wh-islands, because the meaning of these seems to be incompatible with an

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\(^3\) But note that this claim is not uncontroversial, cf. discussion e.g. in Sharvit (1997).

\(^4\) The acceptability of this example shows speaker variation, and also variation across languages. Its French counterpart I am told seems to be consistently unacceptable, while its Hungarian counterpart is acceptable.
embedded infinitival clause. However, since tense in the embedded complement turns weak islands into strong islands, we cannot find weak-islands created by such weakly exhaustive predicates. Therefore, all the examples that we find with *wh*-islands are in fact cases where the question embedding verb requires a strongly exhaustive reading.

3 Wh-Islands that Arise with Degree Questions

This section looks at *wh*-islands that arise with degree questions. The first part is concerned with embedded *whether* questions, discussing examples with the question embedding predicates *know* and *wonder*. It is assumed that the explanation given for these two verbs will carry over to all the other question embedding predicates in their class. In the second half of the section I discuss the case of embedded constituent questions and show that the problem they pose can in fact be reduced to the same problem that made embedded *whether* questions unacceptable in the first place.

3.1 Embedded Whether Questions

*Know-class predicates* I follow Heim (1994) and Beck and Rullmann (1999) in assuming that the exhaustivity of embedded complements is encoded in the lexical meaning of the question embedding verb\(^5\). Given this, let’s represent the lexical semantics of the strongly exhaustive question embedding verb *know* as follows, using a Hintikka-style semantics for attitude verbs. \((Q_{H}(w))\) stands for the Hamblin-denotation of an interrogative.

\[
know(w)(x, Q_{H}(w)) \text{ is true iff } \forall p \in Q_{H}(w), x \text{ knows whether } p \text{ is true in } w
\]

\[
\text{where, ‘} x \text{ knows whether } p \text{ is true in } w \text{’ is true in } w \text{ iff for } \forall w' \in \text{Dox}_x(w),
\]

\[
\text{if } p(w)=1, p \text{ in } w' \text{ and if } p(w)=0, \neg p \text{ in } w'
\]

\[
\text{where } \text{Dox}_x(w) = \{w' \in W: x's \text{ beliefs in } w \text{ are satisfied in } w'\}
\]

**Embedded whether questions with *know*-predicates about individuals** Let’s look at an example of movement out of a *whether*-clause, and its Hamblin denotation:

\[
(6)\begin{align*}
\text{a. Who does Mary know whether she should invite?}
\lambda q. \exists x [\text{person}(x) \land q=\lambda w. \text{knows}(\text{Mary}, \lambda p.[ p=\lambda w'. \text{she}_m \text{ should invite } x \text{ in } w' \lor p=\lambda w'. \text{she}_m \text{ should not invite } x \text{ in } w'])] \text{ in } w
\end{align*}
\]

Assuming that the domain of individuals in the discourse is \{Bill, John, Fred\}, the set of propositions that \(6)b\) describes is \{that Mary knows whether to invite Bill, that

\(^5\) But note that this assumption is not in fact crucial for our analysis.
Mary knows whether to invite John, that Mary knows whether to invite Fred\(^6\). More precisely we might represent this set of propositions as:

\[
\forall w' \in \text{Dox}_M(w), \text{if } \text{invB in } w, \text{ invB in } w' \text{) } \land \text{ (if } \neg \text{invB in } w, \neg \text{invB in } w'\text{)},
\forall w' \in \text{Dox}_M(w), \text{if } \text{invJ in } w, \text{ invJ in } w' \text{) } \land \text{ (if } \neg \text{invJ in } w, \neg \text{invJ in } w'\text{)},
\forall w' \in \text{Dox}_M(w), \text{if } \text{invF in } w, \text{ invF in } w' \text{) } \land \text{ (if } \neg \text{invF in } w, \neg \text{invF in } w'\text{)}
\]

where \(\text{invX in } w\) is a notational shorthand for \textit{Mary should invite X in } w

A complete answer to a question \(Q\) is the assertion of some proposition in \(Q\) together with the negation of all the remaining alternatives in \(Q\). For (6), the meaning we would get if we negated one of the propositions in its denotation is shown below:

\[
\neg[\forall w' \in \text{Dox}_M(w), \text{if } \text{invJ in } w, \text{ invJ in } w' \text{) } \land \text{ (if } \neg \text{invJ in } w, \neg \text{invJ in } w'\text{)]}
\]

\[
= \exists w' \in \text{Dox}_M(w), \text{if } \text{invJ in } w \land \neg \text{invJ in } w' \text{) } \lor \text{ (if } \neg \text{invJ in } w \land \text{invJ in } w'\text{)}
\]

Suppose that we assert \textit{Mary knows whether she should invite Bill} as an answer to the question in (6). The statement that this answer is the complete answer means that we in fact assert that the rest of the alternative propositions in \(Q\) are false: i.e. we assert that Mary knows whether she should invite Bill and that she does not know whether she should invite John and that she does not know whether she should invite Fred:

\[
\forall w' \in \text{Dox}_M(w), \text{if } \text{invB in } w, \text{ invB in } w' \text{) } \land \text{ (if } \neg \text{invB in } w, \neg \text{invB in } w'\text{)}
\]

and

\[
\exists w' \in \text{Dox}_M(w), \text{if } \text{invJ in } w \land \neg \text{invJ in } w' \text{) } \lor \text{ (if } \neg \text{invJ in } w \land \text{invJ in } w'\text{)}
\]

and

\[
\exists w' \in \text{Dox}_M(w), \text{if } \text{invF in } w \land \neg \text{invF in } w' \text{) } \lor \text{ (if } \neg \text{invF in } w \land \text{invF in } w'\text{)}
\]

In the case of questions about individuals thus no problem arises with complete answers: the meaning expressed above is coherent. This is because the alternatives in the question denotation are independent from each other: whether or not Bill is invited in the actual world is independent from whether or not Fred is invited etc.

**Embedded whether questions with know about degrees** Following the analyses of Schwarzschild and Wilkinson (2002), Heim (2006) and Abrusán and Spector (2008), I will assume that degree adjectives establish a relation between individuals and intervals:

\[
\forall w' \in \text{Dox}_M(w), \text{if } \text{invB in } w, \text{ invB in } w' \text{) } \land \text{ (if } \neg \text{invB in } w, \neg \text{invB in } w'\text{)}
\]

and

\[
\exists w' \in \text{Dox}_M(w), \text{if } \text{invJ in } w \land \neg \text{invJ in } w' \text{) } \lor \text{ (if } \neg \text{invJ in } w \land \text{invJ in } w'\text{)}
\]

and

\[
\exists w' \in \text{Dox}_M(w), \text{if } \text{invF in } w \land \neg \text{invF in } w' \text{) } \lor \text{ (if } \neg \text{invF in } w \land \text{invF in } w'\text{)}
\]

\[
\text{a. } \bullet \text{ tall} \equiv \lambda I. \text{all}. x . x \text{'s height } \in I
\]

\[
\text{b. } \bullet \text{ John is I-tall } \equiv I \text{ iff John's height } \in I; \text{ where } I \text{ is an interval:}
\]

---

\(^6\) I restrict my attention to singular alternatives in the discussion. The reader can verify that adding plural alternatives would not change the facts.
c. A set of degrees $D$ is an interval iff
For all $d, d', d''$: if $d \in D$ & $d' \in D$ & $d \leq d' \leq d''$, then $d' \in D$

In the case of a positive degree question the alternative propositions in the question denotation range over different intervals that could be the argument of the adjective:

(11)  - How tall is John? $\Box' = \lambda p. \exists I \in D_1 \land p = \lambda w'. \text{John's height } \in I \in w'$

'For what interval $I$, John’s height is in that interval?'

Given this, the Hamblin denotation of a question with movement of the degree expression out of the embedded question will be as shown below:

(12)  a. *How tall does Mary know whether to be?
   b. $\lambda q. \exists I \in D_1 \land q = \lambda w. \text{Mary, } \lambda p. [p = \lambda w'. \text{height be in } I \in w' \lor p = \lambda w'. \neg \text{height be in } I \in w'] \in w$

We might represent this set informally, as $\{\text{that Mary knows whether her height is in } I_1, \text{ that Mary knows whether her height be in } I_2 \ldots \text{etc, for all intervals in } D_1 \}$, or more precisely as follows: (Notice that if one knows that her height is not in an interval $I$ equals knowing that her height is in the complement of interval $I$ in a given domain of degrees, which I represent as $\neg I$.)

(13)  $\forall w' \in \text{Dox}_M(w), [\text{if } I_1(w) = 1, I_1 (w') = 1] \land [\text{if } \neg I_1(w) = 1, \neg I_1 (w') = 1]$

$\forall w' \in \text{Dox}_M(w), [\text{if } I_2(w) = 1, I_2 (w') = 1] \land [\text{if } \neg I_2(w) = 1, \neg I_2 (w') = 1]$

$\forall w' \in \text{Dox}_M(w), [\text{if } I_3(w) = 1, I_3 (w') = 1] \land [\text{if } \neg I_3(w) = 1, \neg I_3 (w') = 1]$

$\neg I_n(w)$ is a notational shorthand for Mary’s height should be in $I_n$ in $w$.

Imagine now that we were to state Mary knows whether her height should be in $I_j$ as a complete answer. A complete answer equals to the assertion of the most informative true answer together with the negation of all the alternatives that are not entailed by the most informative true answer. Now let’s take 3 intervals: interval 1, interval 2 which is fully contained in 1 and interval 3 which is fully contained in the complement of 1:

(14)  

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>-2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The propositions that Mary knows whether her height is in $I_1$ and that Mary knows whether her height is in $I_2$ and that Mary knows whether her height is in $I_3$ do not entail each other. Thus, asserting that Mary knows whether her height be in $I_j$ as a complete answer would amount to asserting the conjunction that she knows whether her height should be in $I_1$ and that she does not know whether her height should be in $I_2$ or $I_3$:
(15) \( \forall w' \in \text{Dox} M(w), [\text{if } I_1(w) = 1, I_1(w') = 1] \land [\text{if } \neg I_1(w) = 1, \neg I_1(w') = 1] \)
and \( \exists w' \in \text{Dox}_M(w), (I_2(w) = 1 \land \neg I_2(w') = 1) \lor (\neg I_2(w) = 1 \land I_2(w') = 1) \)
and \( \exists w' \in \text{Dox}_M(w), (I_3(w) = 1 \land \neg I_3(w') = 1) \lor (\neg I_3(w) = 1 \land I_3(w') = 1) \)

However, the problem is that the meaning expressed by this tentative complete answer above is not coherent. Suppose first that Mary’s height is in \( I_1 \). The complete answer states that Mary does not know that her height is in \( \neg I_3 \), i.e. in the complement of interval \( I_3 \). From this it follows that for any interval contained in \( \neg I_3 \), Mary does not know that her height is in it. Interval \( I_1 \) is contained in interval \( \neg I_3 \). But now we have derived that the complete answer states a contradiction: this is because it states that Mary knows that her height is in \( I_1 \) and that she does not know that her height is in \( \neg I_3 \), which is a contradiction. We might illustrate the contradiction that arises with the following:

(16) \#Mary knows whether her height is btw 0 and 5 or between 5 and 10
but She does not know whether her height is btw 0 and 3 or between 3 and 10
and She does not know whether her height is btw 0 and 7 or between 7 and 10

It is easy to see that if Mary’s height had to be in the complement of interval \( I_1 \) the same problem is recreated, but this time with interval \( I_2 \).

**Embedded whether questions with wonder–type predicates about degrees**

As a first pass, let’s assume (cf. e.g. Lahir i (2002), Guerzoni and Sharvit (2004)), that the lexical semantics of wonder is the following:

(17) wonder \((w) (x, Q_H(w))\) is defined iff \(\neg \forall p \in Q_H(w), x \text{ believe } p\)
if defined, wonder \((w) (x, Q_H(w))\) is true iff
\(\forall p \in Q_H(w), x \text{ wants-to-know } p \text{ in } w\)

Let’s spell out what it means if \( x \text{ wants to know whether } p \). Using a Hintikka-style semantics for attitude verbs such a meaning could be expressed as follows:

(18) ‘\( x \text{ wants-to-know } p \text{ in } w' \)’ is true in \( w \) iff
for \( \forall w' \in \text{Bul}_x(w) \), if \( p(w) = 1 \), \( x \text{ knows } p \text{ in } w' \)
and if \( p(w) = 0 \), \( x \text{ knows } \neg p \text{ in } w' \)
,where \( \text{Bul}_x(w) = \{ w' \in W \colon x \text{’s desires in } w \text{ are satisfied in } w' \} \)
‘in every world in which x’s desires are satisfied, if p, x knows that p
and if not p, x knows that not p’

Given this meaning, the meaning of question where a degree phrase moves out from the complement of wonder will be as follows:

(19) a. *How tall does Mary wonder whether to be?*
b. \( \lambda q. \exists I \{ I \in D_1 \land q = \lambda w'. \text{wonders (Mary, } \lambda p.[p = \lambda w'. \text{ her}_m \text{ height be in I in } w') \} \text{ in w} \)

Informally, we might represent the set described above as \{that Mary wonders whether her height should be in I, that Mary wonders whether her height should be in I, 2, that Mary wonders whether her height should be in I, 3, etc, for all intervals in D_1\}. Somewhat more precisely we might represent it as below: (Notice that if one wonders whether her height is not in an interval I equals her wondering about her height being in the complement of that interval in a given domain, which I represent as \( \neg I \))

\[
\{ \forall w' \in \text{Bul}_M(w), \text{if } I_{1w}, M \text{ knows } I_1 \text{ in } w' \land \neg I_{1w}, M \text{ knows } \neg I_1 \text{ in } w', \\
\forall w' \in \text{Bul}_M(w), \text{if } I_{2w}, M \text{ knows } I_2 \text{ in } w' \land \neg I_{2w}, M \text{ knows } \neg I_2 \text{ in } w', \\
\forall w' \in \text{Bul}_M(w), \text{if } I_{3w}, M \text{ knows } I_3 \text{ in } w' \land \neg I_{3w}, M \text{ knows } \neg I_3 \text{ in } w', \\
\text{etc. for all intervals in } D_1 \}
\]

, where \( I_{nw} \) is a notational shorthand for Mary’s height should be in \( I_n \) in w.

Imagine now that we were to state *Mary wonders whether her height should be in I* as a complete answer. Now let’s again take 3 intervals as follows: interval 1, interval 2 which is fully contained in 1 and interval 3 which is fully contained in the complement of interval 1:

\[
\begin{array}{cccccc}
1 & & & & & 1 \\
2 & & & & 2 & 1 \\
3 & & & & \neg 3 & 3 \\
\end{array}
\]

Asserting that *Mary wonders whether her height should be in I* as a complete answer would amount to asserting the conjunction that she wonders whether her height should be in I and that she does not wonder whether her height should be in I or I:

\[
\forall w' \in \text{Bul}_M(w), \text{if } I_{1w}, M \text{ knows } I_1 \text{ in } w' \land \neg I_{1w}, M \text{ knows } \neg I_1 \text{ in } w', \\
\text{and } \exists w' \in \text{Bul}_M(w), (I_{2w} \land M \neg \text{know } I_2 \text{ in } w') \lor (\neg I_{2w} \land M \neg \text{know } \neg I_2 \text{ in } w') \\
\text{and } \exists w' \in \text{Bul}_M(w), (I_{3w} \land M \neg \text{know } I_3 \text{ in } w') \lor (\neg I_{3w} \land M \neg \text{know } \neg I_3 \text{ in } w')
\]

However, again the meaning expressed by the tentative complete answer above is not coherent. Suppose first that Mary’s height has to be in I. Then the complete answer states that in her desire worlds, Mary does not know that her height is in \( \neg I_3 \), i.e. the complement of interval I. From this it follows, that for any interval contained in \( \neg I_3 \), Mary does not know that her height is in it. Interval I is contained in interval \( \neg I_3 \). But now we have derived that the complete answer states a contradiction: this is because it states that in her desire worlds, Mary knows that her height is in I and that she does not know that her height is in \( \neg I_3 \), which is a contradiction. Finally, it is easy to see that if Mary’s height had to be in the complement of interval I, the same problem...
would be recreated, but this time with interval $I_2$. We might again illustrate the contradiction that arises with the following:

(23)  #Mary wants to know whether her height is btw 0 and 5 or between 5 and 10
      but She doesn’t want to know whether her height is btw 0 and 3 or btw 3 and 10
      and She doesn’t want to know whether her height is btw 0 and 7 or btw 7 and 10

Interestingly, for both false alternatives, it would have been consistent with the meaning of $p$ to exclude them, but trying to exclude them both at the same time leads to contradiction. Notice that this property connects in a straightforward way to the generalization made in Fox (2007) about non-exhaustifiable sets of alternatives.

### 3.2 Embedded Constituent Questions

Not only embedded whether-constituents, but also embedded constituent questions are wh-islands, as the examples below show:

(24)  a.  ?Which problem does Mary know how to solve?
   b.  *How tall does Mary know who should be?

The unacceptability of (24)b and similar questions can be reduced to the problem that lead to the unacceptability of embedded whether questions in the previous section. First, observe that the Hamblin-denotation of (24)b is as below:

(25)  $\lambda q. \exists I [I \in D_I \land q = \lambda w. \text{knows (Mary, } \lambda p. \exists x [p = \lambda w'. x's height should be in I in w'])$ in w

Informally, the meaning above might be schematized as below:

(26)  \{that Mary knows about $Q_1$, that Mary knows about $Q_2$\}

Imagine that there are 3 individuals in the domain A, B and C, and 3 intervals: interval 1, interval 2 which is fully contained in 1 and interval 3 which is fully contained in the complement of 1, exactly as was assumed in (21) above. Then the informal representation of the denotation of the question above could be as follows:

(27)  \{that Mary knows (for which $x \in \{A, B, C\}$, x’s height is in $I_1$)
      that Mary knows (for which $x \in \{A, B, C\}$, x’s height is in $I_2$)
      that Mary knows (for which $x \in \{A, B, C\}$, x’s height is in $I_3$) \}

Recall that the strongly exhaustive meaning for the question embedding predicate know places a constraint on the true as well as the false alternatives. Given this, our question denotation equals the following set of propositions:
before we proceed, let me insert here a note about negation: it has been al ready observed that the negation of a strongly exhaustive predicate is stronger than expected: e.g. John does not know who came seems to suggest that for no individual does John know whether they came. This is surprising because by simple negation we would only expect a much weaker meaning, according to which John does not know for everyone whether they came. In other words, the question below in (29)a seems to have the stronger meaning shown in (29)b instead of the predicted weaker (29)c:

(29) a. John does not know who came
b. \( \forall p \in Q_{12}(w), \) John does not know whether \( p \)
c. \( \neg \forall p \in Q_{12}(w), \) John knows whether \( p \)

in the discussion that follows i will take this fact at face value, without providing an explanation. Given this, the complete answer conjoins the most informative true answer with the strengthened negation of the false alternatives. now, a complete answer Mary knows who should be \( I_{1}-tall \) will state:

(30) that M. knows whether A’s height \( \in I_{1} \)
& that M knows whether B’s height \( \in I_{1} \)
& that M knows C’s height \( \in I_{1} \),
& that M \( \neg \) know whether A’s height \( \in I_{2} \)
& that M \( \neg \) know whether B’s height \( \in I_{2} \)
& that M \( \neg \) know whether C’s height \( \in I_{2} \),
& that M \( \neg \) know whether A’s height \( \in I_{3} \)
& that M \( \neg \) know whether B’s height \( \in I_{3} \)
& that M \( \neg \) know whether C’s height \( \in I_{3} \)

Looking more closely at the set of propositions above, we can observe that exactly the same problem that arose with the embedded whether questions is recreated, but multiply! observe that each boxed part below corresponds to an embedded contradictory whether question:
Thus the problem of embedded constituent questions simply reduces to the problem of embedded *whether* questions, which have been argued to always lead to a contradiction in the previous section.

## 4 Questions about Manners

I will assume following Abrusán (2007) that the domain of manners contains *contraries* as described below:

(Manners denote functions from events to truth values. The set of manners $(D_M)$ in a context C is a subset of $\{ f \mid E \rightarrow \{0,1\} \} \setminus \emptyset (E)$ such that for each predicate of manners $P \in D_M$, there is at least one contrary predicate of manners $P' \in D_M$, such that $P$ and $P'$ do not overlap: $P \cap P' = \emptyset$.)

Second, although the context might implicitly restrict the domain of manners, just as the domain of individuals, but for any manner predicate $P$, its contrary predicates will be alternatives to it in any context, e.g. *wisely, unwisely*. Finally, we might observe that the law of excluded middle does not hold for manners: for each pair $(P, P')$, where $P$ is a manner predicate and $P'$ is a contrary of $P$, and $P \in D_M$ and $P' \in D_M$, there is a set of events $P^M \in D_M$, such that for every event $e$ in $P^M \in D_M$ [e.g. $P \in D_M$ & $e \notin P' \in D_M$].

Let’s first observe that unfortunately the account proposed for degree questions above does not go through in a straightforward way for manner questions. In analogy with the intervals that we have used for degrees, we might think of contrary manner predicates as exclusive sets of events. Suppose now that the domain of manners contains three exclusive sets of events, i.e. three contrary predicates, e.g. the *politely*, *impolitely*, and *neither politely and impolitely*, which I represent as *med-politely* below. Now, the sets of events that are *politely*-events, the sets of events that are *impolitely*-events and the sets of events that are *med-politely*-events and the events that are in the complement set of these can be represented as follows:

\[
\begin{array}{c|c|c|c|}
\neg \text{med.politely} & \text{med.politely} & \neg \text{med.politely} \\
\hline
\text{politely} & \neg \text{politely} & \\
\hline
\neg \text{impolitely} & \text{impolitely} & \\
\end{array}
\]

Take now an example of a *wh*-island that arises if we attempt to move the manner-expression out of the embedded interrogative:
(34)  a. *How does Mary know whether to behave?
    b. \( \lambda q. \exists a \, [\text{manner}(a) \land q = \lambda w. \text{knows}(\text{Mary}, \lambda p. [p = \lambda w'. \text{she}_m \text{behave in } a \text{ in } w']) \text{ in } w] \)

Assuming that our domain of manners is \{politely, impolitely med-politely\}, we might informally represent the Hamblin denotation of this question as \{that Mary knows whether to behave politely, that Mary knows whether to behave impolitely, that Mary knows whether to behave med-politely, \ldots\}. A word of caution is in order. Notice that given this small domain, the set of alternatives is not the singular set \{that Mary knows whether to (behave politely, behave impolitely, behave med-politely)\}. This is because given the regular meaning of whether, this is simply not what we get compositionally. Given some proposition \( p \), whether \( p \), as defined in the previous section, gives us the set consisting of \( p \) and its complement proposition \( \neg p \): i.e. \{\( p, \neg p \)\}. Whether \( p \) cannot denote the set of propositions that we would get by replacing a manner predicate \( m \) that \( p \) contains by all the contraries to \( m \) in the domain, which is what the second option would amount to in this case. Of course, the set we derive seems a little bit strange, but that is part of the point being made here. By the rules of semantic composition we only get this strange set.

Suppose we tried to assert Mary knows whether to behave politely as a complete answer. If Mary has to behave politely, than her behavior will also be not impolite and not medium polite, therefore in her belief worlds if the event was a politely-event Mary will know that it was not an impolitely-event and not a med-politely event, in other words it would be inconsistent for Mary to know that the event was polite, but not to know that it was also not-impolite and not-medium polite. As a consequence, it is not consistent with the complete answer that the event be polite. However, if the event in question is not a polite one, this is still consistent with it not being impolite (as it might be medium polite) and with it not being medium polite (as it might be impolite). Therefore, it will be coherent for Mary to know that the event was not polite, but not to know whether it was impolite or medium polite. Therefore, unlike what we have seen above in connection with manner questions, the complete answer above does not state a contradiction. However, we still might observe something unusual. While this complete answer is not contradictory, it is nevertheless contextually equivalent to its counterpart with an embedded declarative:

(35)  Mary knows that she should not behave impolitely.

This is because, as we have seen above, polite behavior would have resulted in an inconsistent state of beliefs, but impolite behavior would not have. It is easy to see, that given our earlier assumptions about the domain of contraries this observation generalizes to any complete answer to the question. However, now we might say that the problem with the question is that all of its complete answers are contextually equivalent to sentences which have a stronger presupposition, and therefore the question itself will be ruled out as violation of the principle of Maximize
Presupposition!\(^7\). Notice that a complete answer such as (36)a stands with a vacuous presupposition, but its counterpart with an embedded declarative in (36)b stands with a contentful presupposition:

(36)  
\begin{align*}
\text{a. Mary knows whether to behave politely.} & \quad (\text{vacuous presup.: } p \lor \neg p) \\
\text{b. Mary knows that she should not behave politely} & \quad (\text{presupposition: } \neg p)
\end{align*}

Roughly speaking, the principle of Maximize Presupposition! requires that if we have two alternatives which are contextually equivalent, but one of them comes with a stronger presupposition, we are required to use the one with the stronger presupposition. (But cf. Heim (1991), Sauerland (2003), Percus (2006), Schlenker (2008) for a number of different ways of spelling out this principle in a more precise fashion.) Given this principle, any complete answer to our question will be ruled out in a systematic way as a violation of the principle of Maximize Presupposition. Finally, for any question, if we are in a position to know in advance that every complete answer to it will be ruled out then the question is infelicitous.

In the case of question embedding predicates such as \textit{wonder}, the situation is again a bit different. This is because question embedding predicates such as \textit{wonder} cannot in fact embed a declarative clause, as it is shown in the example below:

(37)  
\begin{align*}
\text{*How do you wonder whether to solve the problem?} \\
\text{a. I wonder whether you should solve this problem fast} \\
\text{b. #I wonder that you should solve this problem fast}
\end{align*}

Therefore, although the meaning of the complete answer is still predicted to be contextually equivalent to a sentence with an embedded declarative, the embedded declarative is independently unacceptable and the explanation for the unacceptability of the question in (37) cannot rely on the principle of Maximize Presupposition. However, I would like to suggest that now the problem with the complete answer is in fact the same that makes it impossible for question-embedding predicates such as \textit{wonder} to take declarative complements: Since it is the essential part of the lexical meaning of \textit{wonder}-type verbs that they express a mental questioning act, a declarative complement (or a complement that is contextually equivalent to declarative one) is simply incompatible with the lexical meaning of \textit{wonder}. It is for this reason then, that that both the embedded declarative, as well any complete answer to (37) above is unacceptable.

### 5 Conclusion

In this paper I have argued that \textit{wh}-islands are unacceptable because they cannot have a complete (exhaustive) answer. In the case of degree questions, the complete answer was shown to express a contradiction, given the assumption that degree questions

\(^7\) I am indebted to E. Chemla (pc) for this suggestion.
range over intervals. In the case of manner questions the problem arose from the fact that a complete answer to these questions was predicted to be equivalent to a sentence with an embedded declarative, which was either a violation of the principle of Maximize Presupposition!, as in the case of question embedding predicates such as know, or simply incompatible with the meaning of the question embedding predicate, which was argued to be the case with predicates such as wonder.

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Abstract
This paper proposes an account of the interpretation of ‘only’ in the antecedents of indicative conditionals. Our concern lies with the implication from a conditional of the form \( \text{if (only } \phi , \psi \text{)} \) to its ‘only’-less counterpart \( \text{if } \phi , \psi \): when and why it is warranted. We argue that the pragmatic relationship of scalar upward monotonicity determines its availability. Two factors serve as license. First, it may arise by virtue of a language user’s pre-existing world knowledge. Second, it may manifest when it constitutes the most informative reading of the conditional available. We discuss one case in point; namely, its appearance when the consequent is desirable.

1 Introduction
Some, but not all conditionals with ‘only’ in the antecedent license the inference to their ‘only’-less counterparts. Thus (1) implies that doing his homework will ensure that Chris passes the class. By contrast, (2) does not convey that Chris’s doing his homework will ensure that he fails the class.\(^1\)

\begin{enumerate}
  \item[(1)]
    \begin{enumerate}
      \item If Chris only [does his homework]\(_F\), he will pass the class.
      \item \(\sim\) If Chris does his homework, he will pass the class.
    \end{enumerate}
  \item[(2)]
    \begin{enumerate}
      \item If Chris only [does his homework]\(_F\), he will fail the class.
      \item \(\not\sim\) If Chris does his homework, he will fail the class.
    \end{enumerate}
\end{enumerate}

The goal of this paper is to explain when and why the implication from ‘if only \( \phi , \psi \)’ to ‘if \( \phi , \psi \)’ holds. Our analysis relies on three main ingredients. The first is the \textit{scalarity} of ‘only’ in cases in which the inference is licensed. Intuitively, both the availability of the inference in (1) and its absence in (2) rely on a construal of the situation in which doing his homework and nothing else is at the “low end,” in terms of effort or cost, of the list of things Chris might do to secure his success in the class. Formally, we argue that the inference, where available, relies in part on an ordering relation between the alternatives invoked by ‘only’. The second ingredient is a relation between this order

\(^1\)The bracketing indicates the location of focus; see Section 4 below for details.
on the one hand, and the truth of the consequent of the conditional, on the other. Simply put, the question is whether, assuming that the alternative antecedents are ranked in terms of effort, the consequent becomes more likely by moving up or down the scale. In the above examples, it is reasonable to assume that expending more effort will make the consequent more likely in (1) but not in (2). We refer to this relationship as scalar (upward or downward) monotonicity. It is distinct from the familiar up/downward monotonicity in terms of entailment: Although we assume that ‘Chris only does his homework’ entails ‘Chris does his homework’ (see Section 4), we will show in the next section that the effects of scalar monotonicity are not limited to such cases.

It is evident from the above remarks that both of the first two ingredients – the scalarity of ‘only’ and the scalar monotonicity between the alternative antecedents and the consequent – crucially depend on the content of the conditional’s constituents. Thus not surprisingly, background world knowledge plays an important role in explaining when and why the inference goes through. The third ingredient of our account goes beyond the immediate goal of explaining the inference in cases in which these relations are common knowledge. Here we show that one can run the account “backwards,” so to speak, and infer from the fact that the speaker chose to use the conditional with ‘only’ in the antecedent, rather than its ‘only’-less counterpart, that the requisite scalar relations hold. This reasoning crucially relies on two elements: the assumption that the speaker is being helpful, and common knowledge as to whether the consequent is desirable or not.

We discuss the data in some more detail in Section 2. Following that, we prepare the ground for our account by laying out our assumption about the semantics of the main ingredients: conditionals (Section 3) and ‘only’ (Section 4). We then spell out the main ingredients, specifically scalar monotonicity, in Section 5. Section 6 is devoted to the role of the desirability of the consequent. We conclude with Section 7.

2 Data

We first point out that the conditionals we are dealing with here are ones in which ‘only’ is embedded inside the antecedent. This is the case for (1) and (2) above, as well as for the examples below. Our analysis does not apply to conditionals with ‘only’ in other positions, such as (3).

(3) Only if Chris does his homework will he pass the class.

The analysis does apply to sentences like (4), however. We realize that an utterance of (4), in addition to making an assertion about Chris’s situation, carries an “evaluative” connotation on the part of the speaker to the effect that Chris’s success is important to him or her. Our analysis does not explain this connotation, but we believe that crucial parts of our analysis are prerequisites for an understanding of it.

(4) If only Chris does his homework, he will pass the class.

\[\text{In fact, it seems plausible that more effort makes the consequent less likely in (2).}\]
As we mentioned above, one main ingredient of our account is what we call scalar monotonicity. We first take a look at its upward version – scalar upward monotonicity, or ‘SUM’ – in more detail, previewing the main ideas of our analysis along the way. We construe the SUM relationship as resting on two components: a scale consisting of a set of alternative antecedents and an ordering on this set; and an upward monotonic relationship between the values on the scale and the consequent. Given these components, SUM holds if and only if: if the consequent is true for some element of the scale, then it is also true for all higher-ranked elements. The case of scalar downward monotonicity is similar.

‘Only’ facilitates the inference by making a scale salient, but is not itself essential. A scale may also arise implicitly from the context. Thus the inferences in (5) and (6) go through despite the absence of ‘only’.

(5) a. If Chris passes the final, he will pass the class.
   b. \( \sim \) If Chris gets a “B+” on the final, he will pass the class.

(6) a. If Chris gets a “B+” on the final, he will fail the class.
   b. \( \sim \) If Chris fails the final, he will fail the class.

On occasion, particular lexical items used in the conditionals in question draw attention to a scale. Thus in (7) and (8), it is the cardinals and gradable adjectives, respectively, that invoke the scale in virtue of their lexical semantics.

(7) a. If you have five dollars, you can buy a medium coffee.
   b. \( \sim \) If you have more than five dollars, you can buy a medium coffee.

(8) a. If you are a lazy student, you will pass the class.
   b. \( \sim \) If you are a hard-working student, you will pass the class.

That the availability of the inference indeed depends on the content of the conditional rather than its logical form is indicated by the reversal of the pattern in (1-a) when the antecedent belongs to a scale of activities which cumulatively lead to failing rather than passing the class.

(9) a. If Chris only \([\text{skips the exam}]_F\), he will pass the class.
   b. \( \not\sim \) If Chris skips the exam, he will pass the class.

(10) a. If Chris only \([\text{skips the exam}]_F\), he will fail the class.
    b. \( \sim \) If Chris skips the exam, he will fail the class.

As mentioned above, we identify two general reasons that scalar monotonicity might manifest. One may know that the relationship holds by virtue of one’s pre-existing knowledge of how the world works. Alternatively, an attempt to derive as informative an interpretation of the conditional as possible may lead one to infer that it holds even in the absence of any supporting world knowledge. The role of informativeness is made plain by its interaction with the desirability consequent. It is possible to infer from the mere fact that the speaker chose to assert ‘if (only \( \phi \)), \( \psi \)’ that a SUM relationship holds, hence ‘if \( \phi \), \( \psi \)’ can be inferred, without knowing so in advance. We observe this with the following conditionals, which fail to provide, at first glance, either a notion of the relevant alternatives to ‘flop’, nor a dimension along which to rank those alternatives,
nor a sense of how the resulting scale relates to the consequent. However, the reader may verify for herself that the second-person subject greatly facilitates the availability of these judgments.

(11) a. If you only [flop]|F, you will win a hundred dollars.
    b. ~F If you florps, you will win a hundred dollars.

(12) a. If you only [flop]|F, you will lose a hundred dollars.
    b. ~F If you florp, you will lose a hundred dollars.

3 Conditionals and Modality

We follow Lewis (1975) and Kratzer (1981) in treating conditionals of the form if φ, ψ as modal expressions. Our assumptions for this paper are very simple: Syntactically, a conditional is composed of a matrix clause and an adverbial headed by ‘if’. We refer to the adverbial clause as the antecedent and to the matrix clause as the consequent. Semantically, ‘if’ introduces a modal operator, restricted by the antecedent, that scopes over the consequent.

The semantic analysis of modal expressions that we adopt is that of Kratzer (1981, 1991; see also Kaufmann, 2005b; Kaufmann et al, 2006; Portner, 2009). Modal operators are interpreted relative to two parameters, a modal base and an ordering source. Both are conversational backgrounds – formally, functions from possible worlds to sets of propositions (i.e., sets of sets of possible worlds.) The modal base provides the domain of modal quantification and determines the kind of modality (e.g., epistemic, doxastic, deontic etc.), analogously to the accessibility relations familiar from modal logic. More specifically, from the perspective of a world w of evaluation and a modal base f, the worlds in the intersection ∩f(w) play the same role as those accessible from w via the corresponding accessibility relation. However, within this set of accessible worlds, some may be more salient, likely, or otherwise relevant to the truth of the conditional than others. This is incorporated by ranking worlds according to their “goodness” with respect to the propositions provided by the ordering source.

Definition 1 (Frame) A frame is a structure ⟨W, f, g⟩ where W is a non-empty set of worlds and f and g are conversational backgrounds, i.e., functions from worlds to sets of propositions.

Definition 2 (Accessibility relation) Given a frame ⟨W, f, g⟩, the accessibility relation Rf determined by f defined as follows: For all w, w′ ∈ W, wRf w′ iff w′ ∈ ∩f(w).

Definition 3 (Relative likelihood) Given a frame ⟨W, f, g⟩, the relative likelihood order determined by g is a three-place relation ≤ on W defined as follows: For all w, w′, w″ ∈ W,

w′ ≤g(w) w″ iff \{p|w″ ∈ p \land p ∈ g(w)\} ⊆ \{p|w′ ∈ p \land p ∈ g(w)\}

3This treatment is too simplistic to account for certain facts. For instance, there is good evidence that the modal operator is not introduced by ‘if’, but by tense. For this and related ideas, see Kaufmann (2005a).
It is easy to show that \( \leq_{g(w)} \) is transitive and reflexive.

For simplicity, we illustrate with a language \( \mathcal{L}_A \), which for now is simply the language of standard propositional logic built on a set \( \mathcal{A} \) of propositional variables. We extend it with a modal operator below.

**Definition 4 (Model)** A model for a language \( \mathcal{L}_A \) is a structure \( \langle W, f, g, \llbracket \cdot \rrbracket \rangle \) such that \( \langle W, f, g \rangle \) is a frame and \( \llbracket \cdot \rrbracket : \mathcal{L}_A \rightarrow (W \rightarrow \{0, 1\}) \) is a valuation function mapping propositional variables and their Boolean compounds to (characteristic functions of) subsets of \( W \).

As mentioned above, we treat conditionals as modal expressions and assume, following Kratzer, that their interpretation depends not only on the modal base, but also on the ordering source. The main role of the ordering source here is to provide the formal basis for a weaker notion of necessity (and a stronger notion of possibility) than that afforded by standard necessity and possibility operators. Kratzer refers to these modal forces as human necessity and human possibility, respectively. The idea is to make certain worlds in the modal base irrelevant to the interpretation of modal expressions. The worlds made irrelevant are those that are strictly “outranked” by others with respect to some contextually salient criterion (plausibility, likelihood, normalcy). The relevant ranking is given by the ordering source, formally represented as a world-dependent pre-order on the set of possible worlds, defined in Definition 3 above. Human necessity is defined with reference to this order as in Definition 5. Human possibility is its dual.

**Definition 5 (Human necessity)** The notion \( \Box \) of human necessity is defined as follows: For all \( w \in W \) and \( \phi, \psi \in \mathcal{L}_A \): \( \llbracket \Box(\phi)(\psi) \rrbracket^{M,w} = 1 \) iff for all \( w' \) in \( \bigcap f(w) \) such that \( \llbracket \phi \rrbracket^{M,w'} = 1 \), there is some \( w'' \) in \( \bigcap f(w) \) such that \( \llbracket \phi \rrbracket^{M,w''} = 1 \) and \( w'' \leq_{g(w)} w' \) and for all \( w''' \) in \( \bigcap f(w) \) such that \( \llbracket \phi \rrbracket^{M,w'''} = 1 \) and \( w''' \leq_{g(w)} w'' \), \( \llbracket \psi \rrbracket^{M,w'''} = 1 \).

Notice that the syntactic form employed in Definition 5 assumes that \( \Box \) is a binary operator. We follow a convention common in linguistics and refer to its two arguments \( \phi \) and \( \psi \) as its restrictor and its scope, respectively. Typically, for simple sentences involving human necessity modals, the restrictor is semantically inert, and the relevant set of worlds is simply \( \bigcap f(w) \). We may account for this by assuming that in the absence of any overt information about the restrictor, the constant function \( \lambda w.1 \) is inserted by default.

In the case of conditionals, we follow Kratzer’s assumption that a covert human-necessity modal is present by default (although that modal force can be overridden by overt modal expressions). Here, the ‘if’-clause does contribute explicit information about the restrictor, while the consequent serves as the scope. The relevant domain of modal quantification, then, consists of those worlds in the modal base where the antecedent holds. Thus we interpret a conditional ‘if \( \phi \), \( \psi \)’ as \( \Box(\phi)(\psi) \).

\[
\text{if}' = \lambda \phi \lambda \psi \Box (\phi)(\psi)
\]

The reason why we use human necessity in the semantics of ‘if’ rather than strict necessity is that human necessity better captures our intuitions about the inferences available with conditionals. In particular, we avoid licensing strengthening of the antecedent.
With strict necessity, we would incorrectly predict that if $\phi$, $\psi$ entails if ($\phi \land \gamma$), $\psi$, for any $\gamma$. Human necessity avoids this problem because the ideal ($\phi \land \gamma$)-worlds relevant for the latter need not be a subset of the $\phi$-worlds relevant for the former. Accordingly, the latter may $\psi$-worlds while the former are not.

Most relevant for our purposes is that human necessity blocks the entailment from if $\phi$, $\psi$ to if (only $\phi$), $\psi$. The intuitive notion is that the “stereotypical” ways of doing $\phi$ may make propositions true that are denied by only $\phi$. For instance, an utterer of (1-b) might take for granted that typically, students who complete their homework also attend class. However, a speaker of (1-a) may have in mind that doing one’s homework is sufficient for passing without any further effort. Clearly (1-b) does not entail (1-a) under these conditions. Nevertheless, a classical account of indicative conditional meaning would predict the entailment from if $\phi$, $\psi$ to if (only $\phi$), $\psi$ under the assumption (which we make – see below) that (only $\phi$) entails $\phi$. Using human necessity as the modal operator correctly allows the implication to fail.

4 Focus and ‘Only’

With a semantics for conditionals and modality in hand, we can now discuss ‘only’. We begin with a bare-bones and intuitive account of ‘only’, and proceed to refine this by appeal to notions of information structure and then finally scalarity.

‘Only’ is commonly analyzed as bearing two distinct semantic components, its positive and its negative contribution. The prejacent of a sentence containing ‘only’ is what remains after removing ‘only’. Thus in (14), the prejacent is (14-a). The positive contribution is the proposition denoted by the prejacent. The negative contribution is the negation of a number of alternative propositions derived in a certain systematic way which relies on a bipartition of the prejacent into two parts, typically referred to as focus and background.

(14) Only Bill slept.
   a. Bill slept.
   b. \{Mary slept, Sue slept, Bill and Mary slept, \ldots\}

Simply put, the alternatives are derived by substituting alternative values for the focus (subject to pragmatic factors such as domain restriction) while holding the background constant. In (14), the focus is ‘Bill’ and the background is ‘slept’. Thus the alternatives are propositions which assert of various individual(s) that it/they slept. It is usually assumed that the prejacent is itself one of the alternatives (Rooth, 1992). The negative contribution is the denial of all alternatives other than the prejacent (Horn, 1996).

It is generally agreed that the negative contribution is an entailment, but there is some debate over whether the positive contribution is implicated, presupposed, or entailed. Without committing ourselves irrevocably to either of these positions, we see good reasons for taking the latter route and assuming that the positive contribution, like the negative one, is an entailment. If it were an implicature, then ‘only $p$’ would literally mean that among the alternatives, at most $p$ is true, but it would be consistent with the
falsehood of \( p \). This would result in the wrong predictions about the conditionals we are concerned with: ‘Chris only does his homework’ would be equivalent to ‘Chris does at most his homework’, leading to truth conditions for (1-a) and (2-a) that are too strong.\(^4\) On the other hand, if the positive contribution were a presupposition, we would expect it to project out of the antecedent, but we see no evidence for that. Thus we assume, at least for the purposes of this paper, that both the positive and the negative contribution are entailed.

We note in passing that while the focus is generally marked by accent placement, the relationship between prosodic accent and semantic focus is not one-to-one and mediated in the standard theoretical approach by an abstract syntactic feature ‘F’. Thus for instance, while the focus marking in (15) would be unambiguously expressed by placing the nuclear pitch accent on ‘walked’ and ‘dog’, respectively, an accent placement on ‘dog’ would be compatible with all three focus markings in (16).

\[(15)\]  
a. John only \([walked]_F\) his dog  
b. John only walked \([his]_F\) dog  
\[(16)\]  
a. John only \([walked his dog]_F\)  
b. John only walked \([his dog]_F\)  
c. John only walked his \([dog]_F\)

The relationship between accent placement and F-marking is the object of a long-standing line of investigation and continues to be debated (Schwarzschild, 1999; Selkirk, 2001; German et al, 2006, among others). An exploration of this topic would lead us too far afield. Instead, for the purposes of this paper, we simply assume that the F-marking in the antecedents in question is given. F-marked constituents are treated as the focus, while the remainder of the clause constitutes the background.

The interpretation of ‘only’ sketched above can be made precise within a Structured Meanings representation (Krifka, 1991, 1995). We assume that ‘only’ syntactically takes sentential scope and applies to an entire structured meaning. Formally, we may represent it as in (17).\(^5\)

\[(17)\]  
\[
\text{only}' = \lambda(F,B,A)[B(F) \land \forall X[(X \in A \land B(X)) \rightarrow X = F]]
\]

To illustrate, the sentence in (18-a), with F-marking as indicated, is interpreted as (18-b), which given the denotation in (17) simplifies to (18-c).

\(^4\)One way to avoid this undesirable result while maintaining that the prejacent is an implicature would be to claim that this implicature is compiled into the literal meaning as part of the interpretation of the antecedent. Such a view would not be without precedent (Chierchia, 2004), but we will not explore it any further here.

\(^5\)Notice that while we assume that ‘only’ composes with a structured meaning, the result is not a structured meaning again. Thus the denotation in (17) does not allow other focus-sensitive expressions “higher up” to associate with a focus in the same clause. See Krifka (1991) for a solution to this problem, which we sidestep here because it is orthogonal to our concerns.
(18) a. John only [did his homework] \(_F\)

b. only \[ \left( \lambda x.\text{do-hw}(x), \lambda P.P(j), \left\{ \lambda x.\text{attend}(x), \lambda x.\text{pass-final}(x), \lambda x.\text{do-hw}(x), \ldots \right\} \right) \]

c. do-hw(\(j\)) \& \\forall X \left[ \left( \lambda x.\text{attend}(x), \lambda x.\text{pass-final}(x), \lambda x.\text{do-hw}(x), \ldots \right) \rightarrow X = \lambda x.\text{do-hw}(x) \right]

The above denotation for ‘only’ denies that alternatives other than the focus truthfully combine with the background. However, not all sentences with ‘only’ seem to make so strong a claim. On occasion, the background may truthfully apply to other alternatives. This happens when ‘only’ bears a scalar tinge: In this case, the alternatives whose truth is not denied are “lesser” in some sense than the focus. For illustration, imagine a selection of lunch choices ordered by size, as in (19-c). A truthful utterance of (19-a) assuredly conveys that John did not eat a hamburger, but need not deny that he had a handful of raisins. There are two distinct readings: on the first, John ate nothing other than an apple; on the second, John ate nothing more than an apple. The data is clearer if we imagine (19-a) as a response to either ‘Did John eat any items from the refridgerator for lunch?’ or ‘Why does John look so famished?’.

(19) a. John only ate [an apple] \(_F\) for lunch

b. Focus alternatives to ‘apple’: \{apple, raisins, pear, cheeseburger\}

c. \langle raisins \preceq \{pear, apple\} \preceq cheeseburger \rangle

Debate lingers over the nature of this scalar reading. One possible approach is to explain it as a restriction on the set of alternatives, stipulating that raisins fails to count as an alternative. However, this misses the fact that even among potential alternatives that are excluded for pragmatic reasons, there is an asymmetry between higher-ranked ones and lower-ranked ones: The former are still denied (counterfactually, as it were) in a way the latter are not. For instance, one does not typically think of steak as a luncheon choice, but (19-c) certainly seems to deny that John ate steak for lunch. Alternatively, the optionality of the scalar reading might suggest that ‘only’ is ambiguous. This approach gains traction from the presence of similar accounts for ‘even’. However, although there may be good reasons for taking this approach in the case of ‘even’, parsimony demands that we consider this a last resort. In the case of ‘only’, several authors (e.g., Bonomi and Casalegno, 1992; Beaver, 2004; van Rooij, 2002) have demonstrated that a uniform scalar denotation for ‘only’ is sufficient. On such an implementation, ‘only’ conveys that the combination of the background and higher-ranked alternatives is false, but crucially makes no claims about the combination of the background with lower-ranked alternatives. The appropriate scale is determined by a contextually given dimension for ranking the alternatives. In the default case, the relevant scale is the semi-lattice of the alternatives with conjunction, thus the relevant “scale” in that case is that of entailment.

Under this approach, we can always assume that a scale ranked by a pre-order \(\preceq\) is available. This allows for a unified account of ‘only’ along the lines of (20).
\( \text{(20)} \quad \text{only}' = \lambda (F, B, A)[B(F) \land \forall X[(X \in A \land B(X)) \rightarrow B(X) \preceq B(F)]] \)

Notice that here we compare \(B(X)\) and \(B(F)\), rather than just \(X\) and \(F\) as in (17) above. The reason for this is that we assume that the scale in question is uniformly one of propositions. In (17), the difference did not matter since if \(X = F\), then \(B(X) = B(F)\). However, since \(B\) may itself contribute to the scalar ordering (e.g., the scale gets reversed if \(B\) contains a negation), from \(X \prec F\) it does not follow that \(B(X) \prec B(F)\), and it is the latter that counts for the truth of the sentence.

### 4.1 ‘Only’ in conditional antecedents

The composition of ‘only’ within the antecedent of a conditional offers no surprises. Intuitively, the result is an interpretation of ‘if only \(\phi\), \(\psi\)’ as ‘if \(\phi\) and no more than \(\phi\), \(\psi\)’. Importantly, \(\psi\) is not ruled out if ‘more than \(\phi\)’ is true. This means that, borrowing from (1), Chris may do other things and still pass the class.

\( \text{(21)} \quad \text{if}'(\text{only } (F, B, A))(\psi) = \Box(\text{only}'(F, B, A))(\psi) = \Box(B(F) \land \forall X[(X \in A \land B(X)) \rightarrow B(X) \preceq B(F)])(\psi) \)

### 5 Scalar Monotonicity and ‘Only’

The implication from if (only \(\phi\)), \(\psi\) to if \(\phi\), \(\psi\) prompted our excursion into the interpretation of ‘only’ conditional antecedents. The implication is present for some conditionals, but absent for others. Our paper explores why the particular asymmetry exists and what might explain it. The answer we arrive at is that the implication is governed by a pragmatically-determined scalar relationship between the antecedent and the consequent of a conditional. Before we go into nature of this relationship, we briefly mention why we discard entailment and ambiguity in ‘only’ as possible explanations. Then, in the remainder of the paper we discuss the role of scalar monotonicity. There are four parts to our discussion. First, we offer a description of what it is to be SUM. Second, we discuss how scalar monotonicity accounts for the implication arising in (1). Third, we supply an explanation of the conditions under which the SUM relationship arises. Lastly, we discuss how the SUM reading may be informative.

#### 5.1 Against ambiguity and entailment as explanations

Here we consider two possible alternative explanations before proferring our SUM explanation. These are first that ‘only’ is ambiguous between a reading that permits the implication and one that does not, and second that the relationship is adequately characterized by entailment.

The most straightforward-seeming hypothesis regarding the asymmetry is that it arises from an ambiguity in the meaning of ‘only’ itself. However, we can account for our data with a single denotation for ‘only’, as we argue below. Parsimony, then, demands that we explain the asymmetry as arising from facts about conditionals rather than an ambiguity with regard to ‘only’ itself.
As for entailment, we find that it offers an inadequate description of the relationship between the sentences in (1). Given that the implication in (1) is from a stronger antecedent to one that is weaker, it is an instance of an upward monotonic inference that has never been claimed valid for conditionals.

5.2 Scalar monotonicity characterized

The above observations are made concrete in the examples below. If ‘if Chris only does his homework, he will pass the class’ is true, then so is the conditional ‘if φ, Chris will pass the class’, for all alternatives φ that are higher than than ‘Chris only does his homework’ on the scale, such as the antecedents in (22-b) and (22-c):

\[(22)\]

a. If Chris only does his homework, he will pass the class.
b. \(\sim\) If Chris does his homework, he will pass the class.
c. \(\sim\) If Chris does his homework and attends class, he will pass the class.
d. \(\sim\) If Chris does his homework and gets caught cheating, he will pass the class.

Working out a formal implementation of this idea is not trivial. Suppose the scale in question is \(\langle \Phi, \preceq \rangle\), and the proposition is \(\psi\). Intuitively, what one would want is a condition on the distribution of \(\psi\)-worlds in the various propositions in \(\Phi\), stating in effect that if \(\psi\) is a human necessity relative to some \(\phi \in \Phi\), then it is also a human necessity relative to all \(\phi'\) such that \(\phi \preceq \phi'\).

To see why this is not trivial, notice first that in order for \(\psi\) to be a human necessity relative to both \(\phi\) and \(\phi'\), it is not required that \(\psi\) be true at all worlds in either \(\phi\) or \(\phi'\). For as we saw above, it is the very point of human necessity that some worlds in the restrictor are made irrelevant to the truth of the modal expression. Without this ability, we would predict that (22-b) entails (22-d) and (22-c), since both instantiate strengthenings of the antecedent. We also saw that this ability is important for our purposes because otherwise we could not account for the fact that even though ‘only \(p\)’ entails \(p\), the conditional ‘if \(p, q\)’ does not entail ‘if only \(p, q\)’.

So we need a more restricted statement roughly to the effect that if we inevitably and inescapably end up in \(\psi\)-territory by inspecting less and less far-fetched worlds in \(\phi\), then the same is bound to happen when we inspect \(\phi'\)-worlds in the same manner. Somewhat more simplified, assuming that there is a set of “best” worlds (technically, local minima) under \(\leq_{g(w)}\) within each \(\phi \in \Phi\), if all the “best” worlds in \(\phi\) are \(\psi\)-worlds, then all the “best” worlds in \(\phi'\) are \(\psi\)-worlds, too. Stating it in this way is easy enough, but we would like to go deeper than that by capturing the conditions under which this outcome is guaranteed in terms of the worlds in \(\phi, \phi'\), and \(\psi\).

The intuition now is that even though the worlds in \(\phi\) and \(\phi'\) may be distinct, there is nevertheless a “correspondence” of sorts which determines, for a given world \(v\) in \(\phi\), which worlds in \(\phi'\) are “at least as good” as \(v\) with respect to the ordering source. This seems straightforward enough, but we cannot be sure that any two worlds in \(\phi\) and \(\phi'\) are even comparable under \(\leq_{g(w)}\). For instance, if \(g(w)\) contains \(\phi\) and \(\phi'\), then no two worlds
are comparable in terms of “goodness” across the two propositions.\footnote{Problems arise under weaker conditions as well. For instance, if \( g(w) \) contains non-empty subsets of \( \phi \) and \( \phi' \), then there are two worlds \( v \in \phi, v' \in \phi' \) such that neither \( v \leq_{g(w)} v' \) nor \( v' \leq_{g(w)} v \). We do not attempt a complete characterization of the problematic cases in this paper.} As an easy way to avoid this problem, we simply stipulate that for all worlds \( w \), \( g(w) \) consists entirely of propositions that have non-empty intersections with all propositions in the alternative set \( \Phi \).\footnote{Ultimately the most elegant solution might be to manipulate \( g \) “online” in the course of the interpretation, filtering our propositions from the ordering source that imposes a ranking among the alternatives.} It is important to keep this in mind in reading the following definition:

**Definition 6 (Scalar Upward Monotonicity)** Let \( M = \langle W, f, g \rangle \) be a model and \( \langle \Phi, \preceq \rangle \) a scale of propositions such that for all \( w \in W \) and \( \phi \in \Phi \), all propositions in \( g(w) \) have a non-empty intersection with \( \phi \). A proposition \( \psi \) is *scalar upward monotone* at a world \( w \in W \) relative to \( \langle \Phi, \preceq \rangle \) if and only if for all \( \phi, \phi' \in \Phi \) such that \( \phi \preceq \phi' \) and all worlds \( v \in \phi, v' \in \phi' \) such that \( v' \leq_{g(w)} v \), if \( z \in \psi \) for all \( z \leq_{g(w)} v \), then \( z' \in \psi \) for all \( z' \leq_{g(w)} v' \).

### 6 Scalar monotonicity and desirability

One factor affecting the availability of the inference concerns the interplay between scalar monotonicity and the interlocutors’ goals. The relevant examples are repeated here. The failure of the inference from (2-a) to (2-b), as well as from (9-a) to (9-b) tends to get strengthened to the conclusion that the (b)-conditional is false.

\[
\begin{align*}
(1) & \quad \text{a. If Chris only \([\text{does his homework}]_F\), he will pass the class.} \\
& \quad \text{b. } \sim \rightarrow \text{If Chris does his homework, he will pass the class.}
\end{align*}
\]

\[
\begin{align*}
(2) & \quad \text{a. If Chris only \([\text{does his homework}]_F\), he will fail the class.} \\
& \quad \text{b. } \neg \rightarrow \text{If Chris does his homework, he will fail the class.}
\end{align*}
\]

\[
\begin{align*}
(9) & \quad \text{a. If Chris only \([\text{skips the exam}]_F\), he will pass the class.} \\
& \quad \text{b. } \neg \rightarrow \text{If Chris skips the exam, he will pass the class.}
\end{align*}
\]

\[
\begin{align*}
(10) & \quad \text{a. If Chris only \([\text{skips the exam}]_F\), he will fail the class.} \\
& \quad \text{b. } \sim \rightarrow \text{If Chris skips the exam, he will fail the class.}
\end{align*}
\]

Assuming competence on the part of the speaker, this follows from two assumptions: First, it is common knowledge that listeners strive to make choices which lead to desirable outcomes, and to avoid negative ones, both with minimal effort; and second, speakers try to impart information that will help listeners in doing so.

For given a scale \( \langle \Phi, \preceq \rangle \) of alternative antecedents and a consequent \( q \), let \( A = \{ p \in \Phi \mid \text{If } p, q \text{ is true} \} \). Then cooperative speakers will choose ‘If \( \min(A) \), \( q \)’ if \( q \) is scalar increasing in \( A \), as in (1-a) and (10-a), and ‘If \( \max(A) \), \( q \)’ if \( q \) is scalar monotone decreasing in \( A \), as in (2-a) and (9-a) (choosing at random if \( \min(A) / \max(A) \) is not unique).

Together with the fact that \( q \) is desirable in (1-a) and (9-a), the listener expects the speaker to choose an antecedent that is *minimal* on its respective scale among those alternatives for which the conditional is true – for knowing the least costly way to guarantee the truth of the consequent is useful both in securing and in preventing the latter.
Antecedents higher on the scale than the minimal ensure the truth of the conditional, too. Likewise, since \( q \) is undesirable in (2-a) and (10-a), the listener expects the speaker to choose an antecedent that is \textit{maximal} on its scale among those alternatives that ensure the truth of the conditional – the listener’s interests are the same way as before, but since the consequent is decreasing in \( A \), knowing the most costly way to ensure its truth is more useful to him. Antecedents higher than the maximal one do not ensure the truth of the conditional. The preceding argument rests on the assumption that \textit{only} is scalar, such that for each of the two scales, \textit{only} \( p \leq p \).

7 Conclusions and Future Directions

We investigated the implication from \textit{if (only} \( \phi \), \( \psi \)\textit{)} to \textit{if} \( \phi \), \( \psi \), arguing that its presence hinges on the availability of a scalar relationship between antecedent and consequent. The pragmatic relationship of Scalar Upward Monotonicity that governs the implication is characterized by three components. SUM first requires a set of alternatives; second, a ranking of the alternatives; and third a relationship between the ranking and the consequent. SUM holds if the consequent remains true when higher-valued propositions are substituted into the antecedent.

Two factors appear to license SUM. First, language users may know of it simply by virtue of their world knowledge. Second, pragmatic considerations may lead them to conclude that it motivates the speaker’s choice of asserting ‘\textit{if only} \( \phi \), \( \psi \)’ rather than just ‘\textit{if} \( \phi \), \( \psi \)’. Future work will explore this link between desirability and scalar monotonicity in greater detail.

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References


Three-Dimensional Semantics

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Abstract
How can identity sentences involving distinct names be informative? Any theory of names facing the problem of informativity will need to appeal to descriptions. The crucial question is: at which level do descriptions play a role? Kripke showed that descriptions neither constitute nor fix the semantic contents of names. At the same time, his Millian views imply the problematic existence of modal illusions: some necessary truths are knowable only aposteriori even though there is no possible world in which they don’t hold. I sketch a new, metasemantic strategy that purports to avoid modal illusions within a referentialist framework: the relevant descriptions describe not extensions (descriptivism), not intensions (two-dimensionalism), but names themselves (three-dimensionalism).

1 Introduction

The primary, Millian intuition about names is that they refer to their bearer directly, without the mediation of descriptive conditions. But, as Frege highlighted, if this intuition is taken seriously, it seems we cannot explain the potential informativity of identity sentences involving distinct names: how can a competent speaker fail to know the truth (or falsity) of a sentence like “Hesperus is Phosphorus”?

Frege had initially proposed, in his Begriffschrift, that what such sentences convey is a piece of metalinguistic information about the names themselves. But later, in Sinn Und Bedeutung, he retracted from his early view, deeming that, after all, what people learnt when they discovered that Hesperus is Phosphorus was a substantive fact of astronomy, and not a metalinguistic fact about the arbitrary signs used to describe that substantive fact. And he introduced senses and descriptivism:

Descriptivism: Descriptions (senses) constitute the semantic content of names.
Kripke, however, refuted descriptivism and rehabilitated referentialism, the view that a name contributes only an individual to truth-conditions. But his Millian views provide no solution to the problem of informativity. This problem, taken within a framework that combines referentialism with a possible worlds semantics, becomes the problem of modal illusions: some necessary truths are knowable only a posteriori even though there is no possible world in which they don't hold. So that the next challenge is this: offer a referentialist theory of names that avoids modal illusions. This is what advocates of two-dimensionalism (henceforth, 2-D) have been aiming to do:

**Two-dimensionalism**: Descriptions fix the semantic content of names.

However, as Byrne and Pryor (2006) emphasize, this strategy too is incompatible with Kripke’s insights. Kripke showed not only descriptions do not constitute the contents of names, but also that they do not fix the contents of names. His central message is that no descriptive conditions, whatever their role, are linguistically associated with names. So that both descriptivist and two-dimensionalist approaches fail.

I want to suggest a third route, one that grants Kripke’s Millianism and puts the descriptions responsible for cognitive significance into the metasemantics and epistemology of language stories. Whereas both descriptivists and two-dimensionalists suppose that descriptions describe extralinguistic objects, I will argue that descriptions describe words:

**Three-dimensionalism**: Descriptions fix public words (in individual minds).

On this view, which I call three-dimensionalism (henceforth, 3-D), the (variable) function that explains informativity is a third function that comes over and above Kaplanian character (or any such reference-fixing function) and content: I call it metacharacter. Metacharacters are functions from possible worlds considered as actual into words. Unlike character and content, which both belong to the semantic story, metacharacter is meant to capture something highly metasemantic, internalistic and often private: the descriptive means through which individual speakers mentally individuate public words. I am aware that the claim that speakers describe public words in a mental language may appear highly controversial. But my hope is to show that this claim may well solve our problem. Some authors have already suggested that questions surrounding the individuation of words may provide the key to solving the problem of informativity. Among them, Kaplan, in *Words*:\(^1\)

> “Could it be that the elusive cognitive difference between believing that Hesperus is Hesperus and believing that Hesperus is Phosphorus rests on nothing more than syntax? [...] My speculations led me to conclude that I had to go back to basics and rethink not just the semantics of names, but their very syntax, the metaphysics of words: How should words be individuated?” (Kaplan, 1990: 93-4)

---

\(^1\) See also Kaplan (1989b: 598-599) for very similar suggestions.
3-D elaborates upon this suggestion, and the resulting view is close in spirit to Frege’s in his *Begriffsschrift*: the discovery that an identity sentence expresses a necessary truth is, for a crucial part, a *metalinguistic* discovery about *words* themselves. What Frege failed to appreciate, however, and what 3-D claims is the key to the problem of informativity, is that the *epistemic* individuation of names involves *substantive* knowledge of how the *actual* world is.

2 Some background

Before I present 3-D in more detail, I wish to state some assumptions that underlie it, and then highlight its continuity with the two-dimensionalist project.

2.1 Six assumptions

(a) *Names are directly referential.*

Kripke showed that names are rigid designators *de iure*. This means that their semantic content is (linguistically meant to be) a *constant* function, yielding the same individual (or set of individuals or substance, in the case of natural kind terms) for all possible worlds of evaluation. Descriptivism, in contrast, is the view that the semantic content of a name is (usually) a variable function, whose value depends on which individual happens to satisfy the corresponding descriptive condition in some possible world of evaluation. So we have:

Referentialism (direct reference, rigidity *de iure*): The intension of a name is constant. Descriptivism: The intension of a name is variable.

I will grant referentialism, and this means that I accept Kripke’s claim to the effect that some necessary truths can be discovered aposteriori. I also agree with him and with Kaplan that whereas necessity and contingency have to do with metaphysics, apriority and aposteriority have to do with epistemology. I think, however, that Kant and Frege were essentially right that anything which is necessary is *ipso facto* apriori. Also, I will, for that matter, line up with two-dimensionalists, who distinguish the bearers of necessity and contingency from those of apriority and aposteriority, although I will eventually disagree with them as to the nature and semantic role of the bearers of apriority and aposteriority. My major concern here is precisely to reconsider *how* necessity and apriority must be disentangled.

(b) *Names are context-insensitive.*

This is a thesis about the character of names. The rival views, here, are:

Minimalism: The character of a name is constant.
Contextualism: The character of a name is variable.

I will, following Kripke and Kaplan, grant minimalism. So I endorse the Millian view that linguistic conventions associate a name directly with its unique bearer; they do not specify descriptive conditions that would have to be satisfied by an individual in order to gain bearerhood. Linguistic conventions settle the bearer from the start. Names are absolute: their character is a constant function from contexts to contents. It follows that the cognitive value of names cannot be explained in terms of their character. Your ignorance of the fact that the sentence “Hesperus is Phosphorus” expresses a truth has nothing to do with your ignorance of facts concerning the context in which the sentence was used. On this view, names are massively ambiguous, and the role of context is not semantic (it is not to determine the reference of a particular name), but merely presemantic (it is to disambiguate which name was used). The view that names are both rigid and absolute—that is, the view that neither the content nor the character of a name are descriptive—I call Millianism.

(c) Semantics is not epistemology of language.

I grant, following Wettstein (1986), that it is not the job of a semantic theory to account for all differences in cognitive value. This is primarily the job of epistemology of language. Strictly speaking, my semantics is not three-dimensional; my semantics is two-dimensional in the benign sense that linguistic rules associate expressions with characters, and characters are functions defined on particular contexts of use.

(d) Some version of social externalism is true.

I follow the main lines of Burge’s (1979) social externalism: which name I use and which content that name has does not ultimately depend on my beliefs, but on social facts. Words are objects in the outer world, about which, importantly, speakers can have imprecise or false beliefs.

(e) Names are individuated by their form and bearer.

Pace Devitt (1981) or Evans (1982), I will assume that a name has its causal source essentially. Here I side with Justice (2001), who defends essentialism about names:

“A name could have another referent only if it could have another bearer, but a name with any other bearer would be another name with its own origin in the naming of that other bearer. Having the bearer it has is an essential property of a name.” (Justice 2001: 362)

So, metaphysically speaking, the name ‘John’ for John Lennon is individuated by its phonological form ‘John’ and John Lennon himself; the name ‘John’ for John Perry is another name, one which happens to share the phonological shape of the name ‘John’ for John Lennon, but not its bearer. Differences in bearers are ipso facto differences in
names. This actually follows from Millianism: linguistic conventions link a name directly with its unique bearer. So, on this metaphysics of names, it is not an essential property of John Lennon’s that he be called ‘John’, but it is an essential property of that name ‘John’ that it is a name for John Lennon only.²

(f) There is only one modal space.

This means that conceivability entails possibility: whatever I can conceive of is metaphysically possible, an assumption commonly found in the literature³, and that I will not discuss further here. Its relevance to the present discussion is that it implies that if something is conceivable then there must ipso facto be some metaphysically possible world in which it holds. We can conceive that the sentence “Hesperus is Phosphorus” is false, and the central aim of our enquiry is to locate and describe the sort of the falsifying possible world that our intuition detects (and which, of course, often explains the progresses of science).

2.2 Two-dimensionalism

3-D borrows some tools from two-dimensionalists. Inspired by Stalnaker’s work on assertion and informativity (1978) and by Kaplan’s (1989a) distinction between the character and the content of indexical expressions, two-dimensionalists have sought to extend the idea of a two-fold meaning to the semantics of names. In the case of indexicals, Kaplan’s view seemed to allow that a competent hearer can grasp apriori, in virtue of her knowledge of character alone, something from my utterance of “I am hungry” even when she doesn’t know precisely who uttered it and hence lacks full knowledge of the context: that the producer of this utterance, whoever she is, is hungry. Two-dimensionalists argue that things are similar with names. Despite Kripke’s arguments to the contrary, they maintain that names are linguistically associated (perhaps implicitly) with reference-fixing descriptions. Also, they think, a hearer can understand something from an utterance of (1)

(1) Hesperus appears in the evening sky.

even when she doesn’t know precisely which world is actual, and in particular doesn’t know which star satisfies the reference-fixing condition being the evening star linguistically associated with the name ‘Hesperus’: that the actual evening star, whatever it is, appears in the evening sky.

The basic idea of 2-D is that there are two ways in which the semantic values of sentences depend on the facts. First, facts play an interpretation role when they determine what is said by a sentence on an occasion of use (this role is similar to that

² The claim here is that both the form and the bearer are essential to the individuation of a name; I do not mean that they are sufficient. In order to get sufficient identity conditions for names additional aspects of the causal chains relating the form of names with their bearers would have to be integrated.

³ But see Soames (2006) for a proposal based on the denial of that assumption.
of contexts in Kaplan’s framework). Second, facts play an *evaluation role* when they determine whether what was said by that sentence is true or false (this role is similar to that of circumstances in Kaplan’s framework). Two-dimensionalists argue that, corresponding to these two forms of dependency to facts, there are two sorts of propositions that are associated with a sentence, which, following Chalmers’s (2006) terminology, may be called, respectively, its *primary* and its *secondary* intensions. *Secondary intensions* just correspond to the traditional functions from possible worlds of evaluation to extensions. For instance, when I utter sentence (1) in the actual world of interpretation $i$, what I say is true with respect to $i$ taken as a world of evaluation, because in the actual world it is Venus that appears in the evening sky, but false with respect to a counterfactual world of evaluation $j$ in which it would be Mars and not Venus that appears in the evening sky, as shown in matrix $A$.\(^4\)

\[
\begin{array}{c|cc}
\toprule
i & T & F \\
\bottomrule
\end{array}
\]

$A$

Now, two-dimensionalists argue that each sentence is associated with a *two-dimensional* matrix, one that captures, in addition to the dependency of truth-values on worlds taken in their evaluation role, the dependency of contents on worlds taken in their interpretation role. Which content a use of a sentence has depends on which world of interpretation turns out to be actual. Speakers have only imperfect knowledge of how the actual world is, so that a lot of possible worlds could, as far as they know, be the actual world. This imperfect knowledge, two-dimensionalists think, is relevant to semantics, for which world is *considered to be the actual world of interpretation* determines which secondary proposition gets actually expressed by a sentence. Had the actual world of interpretation been $j$ and not $i$, then sentence (1) would have received a different content, one which is true in all worlds of evaluation in which it is Mars which is the star that appears in the evening sky, as shown in matrix $B$:\(^5\)

\[
\begin{array}{c|cc}
\toprule
i & T & F \\
\hline
j & F & T \\
\bottomrule
\end{array}
\]

$B$

Stalnaker calls a two-dimensional matrix like $B$ a *propositional concept*: this is a function from possible worlds of interpretation into propositions. The worlds in the vertical rows are worlds taken in their interpretation role (contexts), and the worlds in the horizontal row are worlds taken in their evaluation role (circumstances). Each horizontal line thus represents a distinct proposition. Now, two-dimensionalists claim,


there is another important proposition which can be recovered from $B$: this is the primary intension they are after. Stalnaker calls it the diagonal proposition, because it corresponds to “the function from possible worlds into truth-values whose values are read along the diagonal of the matrix from upper left to lower right” (1978: 81). This is the proposition which is true for any world of evaluation $w$ when $w$ is also taken to be the world of interpretation, or, equivalently, it is the set of worlds of interpretation (contexts, if you like) in which the sentence is true. Importantly, the primary intension is also the proposition that the competent speaker knows a priori to be true, regardless of how the actual world of interpretation happens to be.

2-D comes in many versions; these differ in how they construe the worlds of interpretation and the primary intensions. As Chalmers (2006: 64) summarizes, the common denominator of all versions of 2-D is to relate the cognitive significance of a sentence with its primary intension:

Core thesis of 2-D: A sentence $S$ is metaphysically necessary iff its secondary intension is necessary; $S$ is epistemically necessary (a priori) iff its primary intension is necessary.

Correspondingly, a sentence $S$ is necessary a posteriori iff its primary intension is contingent and its secondary intension is necessary; and $S$ is contingent a priori iff its primary intension is necessary and its secondary intension is contingent.

3 Three-dimensionalism

My rejection of 2-D here simply follows from my assumption that Millianism is correct: both the character and the content of a name are constant functions. But then, given Millianism, the only way to solve the problem of informativity is to go metalinguistic. Indeed, it follows from Millianism that there is no possible world of evaluation in which Hesperus is not Phosphorus (names are rigid) and no possible world of interpretation in which the names ‘Hesperus’ and ‘Phosphorus’ have distinct contents (names are absolute). So if it is conceivable at all for a competent speaker that the sentence “Hesperus is Phosphorus” express a falsehood, this must be because that speaker, although competent, lacks some piece of metalinguistic knowledge about the words themselves. Donnellan once remarked:

“If we distinguish a sentence from the proposition it expresses, then the terms ‘truth’ and ‘necessity’ apply to the proposition expressed by a sentence, while the terms ‘a priori’ and ‘a posteriori’ are sentence relative. Given that it is true that Cicero is Tully [...], ‘Cicero is Cicero’ and ‘Cicero is Tully’ express the same proposition. And the proposition is necessarily true. But looking at the proposition through the lens of the sentence ‘Cicero is Cicero’, the proposition can be seen a priori to be true, but through ‘Cicero is Tully’ one may need an a posteriori investigation.” (Donnellan, 1983: 88)
In the same spirit, Tichy (1983: 231) draws a distinction between the proposition expressed by a sentence S in a language L (what S says in L) and the proposition associated with S (“the proposition to the effect that S is true in L”), and notes:

“Kripke must think that the net result of the scientists’ efforts was a semantic discovery. What they established is that the term ‘heat’ names molecular motion and that accordingly sentence (2) [“Heat is molecular motion”] states the truism that molecular motion is self-identical. In other words, they discovered the truth of the proposition associated with (2); it is that proposition which is only knowable a posteriori, through hard experimental slog.” (Tichy, 1983: 234-5)

Drawing on Donnellan’s and Tichy’s suggestions, Wong (1996; 2006) has recently argued that the bearers of apriority and aposteriority are not propositions simpliciter (that would be the absolute view of apriority) but propositions relative to sentences (the relative view). Here’s the core thesis of the relative view of apriority:

“A proposition \( p \) is a priori relative to a sentence \( S \) that expresses it if and only if \( S \) is a priori; \( p \) is a posteriori relative to a sentence \( S’ \) that expresses it if and only if \( S’ \) is a posteriori. [...] Some may want to replace ‘a sentence \( S’ \) by something like ‘a way of taking \( p \)’ or ‘a mode of access to \( p \)’. Indeed, a major task in elaborating the relative view is to answer the question, ‘What is it that a proposition can be said to be a priori relative to?’” (Wong, 1996: 67)

3-D’s answer is: relative to the epistemic individuation of words. The descriptions through which a speaker individuates the words ‘Hesperus’ and ‘Phosphorus’ are the lenses, mentioned by Donnellan, through which this speaker fails to see that the sentence “Hesperus is Phosphorus” expresses a necessary truth. The problem is not semantic, but metasemantic: it has to do with how our speaker individuates the public names in her mind, and more specifically with what she wrongly believes or fails to know about these names.

### 3.1 The meaning-constitution problem

Before I go further, I wish to introduce a potential problem that threatens to undermine any metasemantic account like 3-D. García-Carpintero (2006) calls it the “meaning-constitution problem.” Stalnaker (2006) contrasts between two interpretations, semantic and metasemantic, of the two-dimensionalist framework. On the semantic interpretation, primary intensions are semantic values that sentences have in virtue of linguistic conventions. Stalnaker claims that, granting Millianism, this interpretation gets automatically excluded: names are not linguistically associated with reference-fixing descriptions. Stalnaker (2001: 150, 152; 2006: 301) therefore urges that only the metasemantic interpretation of the framework could make sense, and I agree with him on that point. But, Stalnaker (1999: Introduction; 2001; 2006) goes on to argue, the metasemantic construal has the consequence that the meanings of names can vary
freely across worlds of interpretations, hence it appears to imply that no diagonal proposition will ever be necessary, and therefore that the metasemantic interpretation makes any account of apriori knowledge impossible:

“Since the metasemantic two-dimensional intension represents all the ways in which the reference or content of an expression depend on the facts, it will not provide any non-vacuous account of a priori truth. To say that a primary proposition associated with a sentence was necessary would be to say that the sentence would express a truth whatever it meant, and that notion, of course, will have no application.” (Stalnaker, 2001: 155; my underlining)

Thus, the reasoning underlying Stalnaker’s skepticism is this: given Millianism, a metasemantic interpretation must assume that words that are carried across worlds of interpretation are individuated by their phonological form alone if their meaning is allowed to vary at all, so that words end up having any arbitrary meaning relative to all possible worlds considered as actual. In other words, the primary proposition would, on the metasemantic interpretation, reflect all the possible meanings that names could have in all possible languages. This, then, is the meaning-constitution problem.

Interestingly, the worries expressed by Stalnaker resemble the reasons which led Frege to abandon the early metalinguistic view of his Begriffschrift. And here I disagree. I think that Stalnaker’s point shows not that no Carnapian connection holds between apriori knowledge and linguistic conventions, but only that the relevant diagonal, the one that accounts for apriori knowledge, is of another sort, and must be construed differently. On my account, the key to overcome the meaning-constitution problem is to contrast between two types of metasemantic facts: metaphysical metasemantic facts (facts relevant to the metaphysical individuation of words) and epistemic metasemantic facts (facts relevant to the epistemic individuation of words). My view is then that something epistemic about the word can vary from world to world even though the metaphysical word itself remains, as Millianism requires, fixed.

3.2 Metaphysical vs epistemic individuation of words

I have assumed that, metaphysically speaking, its bearer is essential to a name. As a consequence, sentences (2) and (3) must express necessary truths about our language:

(2) ‘Hesperus’ designates Hesperus.
(3) ‘Hesperus’ designates Phosphorus.

But then, how can a competent speaker discover that those metalinguistic truths only aposteriori? After all, if I am linguistically competent, then I should know that the propositions expressed by those sentences are true, since I do have a reliable grasp on what these names designate. The key is that, somehow, my epistemic situation is such that, for all I know, the actual language might be one in which these two names are not coreferential, even though, metaphysically speaking, there is no possibility that our
actual language be such that the two names would not corefer. Importantly, this can only be because my cognitive access to public words themselves is mediated by some *inner description of words*. Also, *epistemically* speaking, a name is individuated by its form and a *description* of its bearer. My descriptions of the words ‘Hesperus’ and ‘Phosphorus’—the *lenses* through which I see them—are somehow too vague and too general to exclude the possibility that they don’t corefer. The *epistemic* individuation of a public name thus involves a description of its bearer, which is used within a *(mental) reference-fixing description of the name* itself.

3.3 Linguistic competence

One point of claiming that the informativity of the sentence “Hesperus is Phosphorus” is a *metasemantic* matter is to maintain that even a *linguistically competent* speaker can fail to see that this sentence is true. Here is how I define linguistic competence:

**Linguistic competence:** In order to be linguistically competent with respect to a name N, a speaker must have the capacity to reidentify the bearer of N as the bearer of N through a *substantive* description that uniquely picks out the individual which is the bearer of N in the *actual* world.

So, for instance, in order to be competent with respect to the name ‘Aristotle’, all you need to know is the form of the name and one description that uniquely picks out Aristotle in the *actual* world, like the *tutor to Alexander the Great* or any other description identifying only Aristotle in the actual world. With this knowledge at hand, you will be able to correctly identify, in the actual world, the name ‘Aristotle’ itself: you will know of this name (i) that it has the phonological form ‘Aristotle’, and (ii) that its bearer was the tutor of Alexander the Great. But on that definition of linguistic competence, and because that definition requires only to have a *contingent* description of the bearer (one satisfied by the bearer in the *actual* world), there are lots of things you can still discover about a name with respect to which you are, nonetheless, already perfectly competent. This definition of linguistic competence paves the way for a definition of metacharacters.

3.4 Metacharacters

Metacharacters can be defined in either of two equivalent ways. They can be seen either as functions from possible worlds considered as actual to words, or as functions from possible languages considered as actual to words. Both understandings are fine here, because on my view possible languages cannot vary independently of possible worlds, and each possible language is determined by exactly one possible world. It must, however, be borne in mind that a central idea of 3-D is that what we discover when empirical investigation reveals a necessary truth is also something about the *language*. Consequently, what we want as a result of my discovery is that I exclude
some languages from the set of languages compatible with my metalinguistic beliefs, and not only that I exclude some worlds from the set of worlds compatible with my beliefs.

Consider John, who is a linguistically competent speaker of English. He knows that the following sentences express truths about English:

(4) ‘Hesperus’ is a name for the actual evening star.
(5) ‘Phosphorus’ is a name for the actual morning star.

John is linguistically competent, on the standards just defined, because both of those contingent substantive descriptions uniquely identify a certain star in the actual world, and because that star is indeed an essential ingredient of what metaphysically individuates both of the words ‘Hesperus’ and ‘Phosphorus’. (In order to count as linguistically competent with respect to the sentence “Hesperus is Phosphorus”, the minimal information that John has to recover from it is the proposition that the actual evening star is the actual morning star. Although general, this proposition is rigid de facto—because of ‘the actual’—so that its secondary intension is equivalent to the singular proposition semantically expressed, viz. that Venus is Venus. So the general proposition corresponding to linguistic competence and the singular proposition which is semantically expressed by the sentence share the same truth-value in all possible worlds of evaluation.) However, as far as John’s metalinguistic knowledge is concerned, the actual public word ‘Hesperus’ could still be a lot of words. This is because John doesn’t know precisely which world, among, say, $w_1, w_2, \text{ and } w_3$, is the actual one, and especially he doesn’t know exactly which entity, among Venus, Mars, and Uranus, is the actual evening star:

\[
\begin{align*}
  w_1 & \rightarrow \text{Venus} \\
  w_2 & \rightarrow \text{Mars} \\
  w_3 & \rightarrow \text{Uranus}
\end{align*}
\]

It follows that his metalinguistic knowledge of the word ‘Hesperus’ is imperfect because, as far as he knows, three words could still equally plausibly be the actual word ‘Hesperus’, depending on which entity turns out to be the actual evening star:

*Venus-word:* The word ‘Hesperus’ picks out Venus in the actual public language, because the actual evening star is Venus;

*Mars-word:* The word ‘Hesperus’ picks out Mars in the actual public language, because the actual evening star is Mars;

*Uranus-word:* The word ‘Hesperus’ picks out Uranus in the actual public language, because the actual evening star is Uranus.

As far as John is aware, the actual word ‘Hesperus’ might be either of these three words, depending on which world (hence, language) turns out to be the actual one.
This dependency is precisely what the *metacharacter function* is meant to capture. John’s linguistic competence is fine, but his metalinguistic competence is imperfect because his knowledge of the actual world (hence, of the actual language) is imperfect.

**2-D picture**: ‘Hesperus’ (The associated description describes an *object*.)

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**3-D picture**: ‘Hesperus’ (The associated description describes a *word*.)

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</tbody>
</table>

The constancy in each *horizontal* row of both matrices reflects John’s knowledge that, respectively, names in general are rigid because they have their bearer essentially. In the three-dimensional analysis, if the actual world is the Venus-world, then it will be an *essential* property of the name ‘Hesperus’ that it picks out Venus as its referent, and if the actual world turns is Mars-world, then it will be an essential property of the name ‘Hesperus’ that it picks out Mars as its referent, etc. The metacharacter that John associates with the word ‘Hesperus’ is given by the *diagonal* of this matrix. This diagonal reflects John’s knowledge that whichever world (language) turns out to be actual, the public word ‘Hesperus’ is such that it is a word essentially for whatever is the evening star in that world. That piece of knowledge is sufficient for *linguistic* competence, but it is not sufficient to grasp the *metalinguistic* proposition that ‘Hesperus’ and ‘Phosphorus’ corefer, because it doesn’t entail anything about whether or not the actual evening star is the actual morning star. The effect of an assertion of “Hesperus is Phosphorus” on John is double: (i) eliminate all the possible *worlds* in which the evening star is not the morning star from the set of worlds compatible with his knowledge of the actual world; (ii) eliminate all the possible *languages* in which the two names do not corefer from the set of languages compatible with his knowledge of the actual language, that is, modify his *metalinguistic* competence. (His linguistic competence remains unchanged.)

### 3.5 The solution to the meaning-constitution problem

We are now in a position to overcome the meaning-constitution problem and disavow Stalnaker’s skepticism about a metasemantic account of apriori knowledge. It follows from my definition of linguistic competence with respect to a name that each
A competent speaker must possess at least a **substantive contingent description which is uniquely satisfied by the bearer in the actual world**. That description stops the regression Stalnaker worries about, because it restricts the (infinite) set of arbitrary meanings that a phonological shape could have to the (finite) set of words that an actual word might be **as far as a competent speaker's knowledge of the word is concerned**. So it is the descriptions used to epistemically individuate the names that are kept constant across worlds (languages) considered as actual, and, importantly, these descriptions can, even for a linguistically competent speaker, still pick out different names at different worlds (languages). To say that John is linguistically competent with respect to the name ‘Hesperus’ is to say that he knows **enough** of the actual world to know that not everything could plausibly be the actual evening star **and hence that he knows enough of the actual world to know that not everything could plausibly be the word ‘Hesperus’**. Since he knows the truth of the metalinguistic sentence (6),

(6) ‘Hesperus’ is a word for the actual evening star.

John knows **apriori, in virtue of his metacharacter alone**, that the object-language sentence (7)

(7) Hesperus is the evening star.

will express a truth in the actual world (language), **whatever the actual world (language) turns out to be**. And this is the result we were after. Only, metacharacters are often private, and apriori knowledge in general will need to be relativized to individual speakers (at particular times). But the account will hold regardless of the particular descriptions that individual speakers use to mentally individuate a public word, so long as these descriptions are substantive descriptions which are uniquely satisfied by the bearer in the actual world. This, then, is the sense in which linguistic conventions and apriori knowledge are connected. Carnap vindicated!

4 Conclusion

The sentence “Hesperus is Phosphorus” can be informative even to a linguistically competent speaker because, although she must know at least a (rigidified) general proposition (hence, one cointensive with the singular proposition semantically expressed by the sentence), she is not required to know the metalinguistic proposition **that the words ‘Hesperus’ and ‘Phosphorus’ corefer**. This metalinguistic proposition is necessary, because, metaphysically speaking, names have their bearers essentially. But our speaker, although competent, ignores it, because she epistemically individuates the names through descriptions that are only contingently true of the bearer in the actual world, and is not aware that the description she uses for the bearer of ‘Hesperus’ and the description she uses for the bearer ‘Phosphorus’ pick out the same individual in the actual world (language). Metacharacters capture the connection
between linguistic conventions and apriori knowledge, and do so by reflecting what a competent speaker must know of the names regardless of precisely which world and language happen to be actual.

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Modifying Event Nominals: Syntactic Surface Meets Semantic Transparency

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Abstract

The paper starts out with the observation that modifiers to eventive ung-nominals can both target at the denoted event as a whole and modify it from inside. The internal reading will be shown to challenge iconic mapping between surface-oriented c-command and semantic scope. By using Egg (2006)’s flexible syntax-semantic interface the given ambiguity is analyzed as landing site underspecification allowing for a compositional make-up in both cases: based on a bipartite eventive structure for ung-nominals, the internal reading is argued to result from applying the modifier to an event concept fed by the verbal lexical base whereas the external reading emerges if the modifier targets at a concept-correlate introduced by the nominal affix.

1 Introduction

In event semantics, ample evidence has been put forward in favor of correlating syntactic position and interpretation of German adverbial modifiers, cf. e.g. Maienborn (2003), Pittner (2004) and related work. (1) and (2) are indicative:¹

(1) a. Paul hat die Daten schnell verarbeitet.
    Paul has the data fast processed.
   b. Paul hat schnell die Daten verarbeitet.
      Paul has fast the data processed.

(2) a. Der Koch hat das Huhn in einer Pfeffersauce zubereitet
    the cook has the chicken in a pepper-sauce prepared
   b. Der Koch hat in der Küche das Huhn zubereitet
      the cook has in the kitchen the chicken prepared

¹A close relation between syntax and semantics of adverbials is also suggested by Principle-C-effects, quantifier scope, remnant topicalization, focus projection. I will not discuss these.
The adverbials are interpreted event-externally if projected in V-adjacent position as in (1-a) and (2-a). The AP thus specifies the manner of the processing as fast, the PP localizes an integral constituent of the cooking event, i.e. the chicken, in the peppersauce. On the contrary, if adverbials are in a higher position next to the VP as in (1-b) and (2-b), they are interpreted event-externally, i.e. they relate holistically to the event. In this case, the AP specifies the time span of the whole processing event or the time span between its initiation and some reference point as short. The PP situates the preparing event in the kitchen.

These findings can straightforwardly be accounted for by mapping syntactic c-command on semantic scope. The according intuition behind a compositional make-up is that adverbials c-command the semantic entity they relate to. Haider (2002, 61) and related work implement this idea by proposing the interface criterion and isomorphic relation given in (3). (4) illustrates the point:

(3) a. Interface criterion: Syntactic c-command domains are mapped monotonically on incrementally structured semantic type-domains.
   b. Isomorphic relation:
      (i) semantics: Proposition ⊂ Event ⊂ Process/State
      (ii) structure: ['p-related' ['e-related' ['l-related']]]

(4) Paul hat [p-related] Vermutlich [e-related] am Montag [sein appartement]
   Paul has [p-related] presumably on monday his appartment
   [l-related] sorgfältig [aufgeräumt]]]
   l-related carefully cleaned

The sentence adverbial being bound to the proposition is projected higher than the temporal one taking scope over the event; the manner specification being related to the lexical verbal base is embedded most deeply.

The challenge to be addressed in the present paper is the following: event nominals with the affix -ung that correspond to the examples in (1) and (2) do not show the same structural effect thus casting doubt on a straightforward mapping between syntactic surface and semantic scope. In case of a prenominal modifying adjective, both l-related internal and e-related external reading are conveyed by the same surface structure, cf. (5) and (6) with their respective readings:

(5) die schnelle Verarbeitung der Daten durch Paul
   the fast processing the data GEN by Paul
   a. ‘the processing activity itself is fast’ (internal reading)
   b. ‘the time span of the whole event or that between its initiation and some reference point is short’ (external reading)

2 Maienborn considers internal locatives semantically underspecified, cf. section 3 for details.
3 Haider uses the term ‘l-related’ because he assumes that the verbal lexical base determines the denotation as a process/state.
(6) die dumme Anbiederung
   the stupid fawning-on
   a. ‘event of stupidly fawning on sb.’ (internal reading)
   b. ‘event of fawning on sb. is evaluated as stupid’ (external reading)

The holistic external readings are expected by syntax in that the AP c-commands the whole following nominal structure. In their internal reading, however, the modifiers relate to the verbal lexical base italicized in the examples above, that is, they apply to just one part of the expression modified syntactically. These thus challenge strict compositionality in the nominal domain.

This mismatch is corroborated by postnominal modifying PP: in case of specifying the I-related manner reading by a postnominal prepositional phrase, the structure differs from the VP in ruling out head-adjacency of the modifier, cf. (7). The same holds for locatives: even if interpreted internally, they do not surface in head-adjacent position but in distance, cf. (8).

(7) a. die Verarbeitung der Daten auf schnelle Weise
   the processing the data\textsubscript{GEN} in fast manner
   b. *die Verarbeitung auf schnelle Weise der Daten
   the processing in fast manner the data\textsubscript{GEN}

(8) a. die Zubereitung des Huhns in einer Pfeffersauce
   the preparation the chicken\textsubscript{GEN} in a pepper-sauce
   b. *die Zubereitung in einer Pfeffersauce des Huhns
   the preparation in a pepper-sauce the chicken\textsubscript{GEN}

One might argue that the reason for this is syntactic: German adnominal genitive can only be checked in N-adjacent position, cf. e.g. Sternefeld (2006, 587-589).\footnote{This is not quite the whole story. If the genitive is substituted by a PP with von (‘of’), the theme argument cannot be projected in distance either, cf.:}

(i) *die Zubereitung in einer Pfeffersauce von Hühnern
   the preparation in a pepper-sauce of chickens

One could argue that in such cases von functions as a case-like feature since it substitutes for the bare genitive which is ungrammatical here. Or one might account for the distribution by some hierarchy constraint. However, if one relies on a hierarchy, it seems even more urgent to explain why internal modifiers cannot project before the theme’s projection as attested in the VP.

\footnote{This is not quite the whole story. If the genitive is substituted by a PP with von (‘of’), the theme argument cannot be projected in distance either, cf.:}
c-commands the nominal, but not merely the verbal lexical base it in fact contributes to in its internal reading.\(^5\)

Finally, note that the locative in (8-a) could also be read externally if its pragmatic nonsense is neglected; cf. (9) for a clearly conceivable example:

\[(9)\] die Zubereitung des Hühnchens in der Küche
the preparation the chicken\(_{\text{GEN}}\) in the kitchen

To sum up: the data on modifiers to event nominals are at odds with compositional semantics based on surface structure. In their internal reading, i.e. in their being related to the lexical verbal base, adnominal modifiers apply to just one part of the expression modified syntactically. The present paper aims at compositionally deriving external vs. internal reading via a flexible syntax-semantic interface built upon underspecification. I will first present Egg (2006)’s analysis of well-known bracketing paradoxes as good dancer similarly involving internal modification not expected by simple c-command and apply it to the adnominal AP modifiers from above (section 2). Second, I will extend the proposal to PP modifiers by comprising Maienborn (2003)’s free variable approach to internal locatives (section 3).

2 Scopally underspecified AP modifiers

2.1 Scope underspecification in Egg (2006)

Examples as good dancer are well-known for being ambiguous between reading (10-a) und (10-b).\(^6\) A plausible structure is given in (11).

\[(10)\]
\[\lambda x. \text{good}'(x) \land \text{GEN}[e, y](y \text{ in } e \land y = x, \text{dance}'(y)(e))\]

\[\lambda x. \text{GEN}[e, y](y \text{ in } e \land y = x, \text{good}'(e) \land \text{dance}'(y)(e))\]

\[(11)\]
\[
\begin{array}{c}
\text{NP} \\
| \\
\text{N'} \\
| \\
\text{AP} \\
| \\
\text{A} \\
| \\
\text{N} \\
| \\
good \text{ danc-er}
\end{array}
\]

In reading (10-a), the modifier has scope over the complex nominal. This is expected by the c-command relations in surface structure (11). Reading (10-b) though is in conflict with an iconic mapping between c-command and semantic scope because the

\(^5\)A movement analysis also has to capture the data on prenominal AP; I do not know how to reasonably argue that they are base-generated in N-adjacent position. Such base position implies the bracketing [A+N] and subsequent movement of this complex constituent.

\(^6\)I took Egg (2006)’s representation. GEN codes habituality; see Egg (2006, 6) for details.
Egg (2006) reconciles surface syntax and scope by using the following ingredients of the underspecification formalism CLLS (= Constraint Language for Lambda Structures) as developed in Egg et al. (1998) and Egg et al. (2001). First, it is assumed that the semantics of constituents C contains a main and a secondary fragment. Second, built upon surface structure, complex C are construed by syntax-semantic and morpho-semantic interface rules (= SSI and MSI) which can address both fragments. Third, these SSI- and MSI-rules result in dominance diamonds that possibly have different solutions. These different solutions then correspond to the final readings available for the structure computed.

Applying this procedure to *good dancer* leads to the following diamond, cf. Egg (2006) for details:

![Diagram](image)

(12)

\[ \lambda x. \text{GEN}[e, y] (y \in e \land y = x, \Box (e)) \quad \lambda z. \Box(z) \land \text{good}'(z) \]

dance'(y)

The diamond consists of \( \lambda \)-terms representing the semantic fragments involved. ‘Holes’ (symbolized by \( \Box \)) indicate their unknown, hence underspecified parts. Dominance relations (symbolized by dotted lines) attach fragments and holes to each other and thereby model scope. (12) can be read as follows: the final structure is not fixed; this motivates the hole at the top. The left fragment represents the meaning contribution of the affix -er, the fragment on the right side adds the meaning of the modifier *good*. While their scope interaction is not determined (i.e. neither fragment dominates the other), the lexical verbal base has necessarily narrow scope and is thus located at the bottom.

The possible solutions are calculated by monotonically identifying fragments and holes. By first identifying the right-hand hole with the top, the modifier takes scope over the full NP, cf. repeated from above (13-a). Starting from the left, i.e. identifying first the hole in the left fragment with the topmost hole, derives the critical internal reading with wide scope of the affix, cf. (13-b):

(13) 

a. \[ \lambda x. \text{good}'(x) \land \text{GEN}[e, y] (y \in e \land y = x, \text{dance}'(y)(e)) \]

b. \[ \lambda x. \text{GEN}[e, y] (y \in e \land y = x, \text{good}'(e) \land \text{dance}'(y)(e)) \]

The suggested formalism can hence systematically derive both readings on the basis of a uniform surface-oriented syntax and common assumptions on the meaning of the involved lexical items. In the next section, the given analysis will be transferred to the modification of event nominals.

---

7Here, CLLS’s underspecified representations will be used in a simplified form.
8Taking advantage of a powerful semantic construction, Egg’s proposal can do without the assumption of underlying syntactic structure different from surface. This contrasts with e.g. Larson (1998) who ensures iconic mapping at the syntax-semantic interface by postulating an elaborate invisible syntax being the input for semantics, cf. Egg (2006, 7-9) for some discussion.
2.2 Underspecified AP modifiers to event nominals

Recall the task: how can one compositionally derive internal vs. external reading of *schnelle Verarbeitung der Daten* (‘fast processing of the data’) on the basis of surface structure (14) and standard semantics for the involved lexical units in (15):

\[
\text{(14)} \quad \begin{array}{c}
\text{NP} \\
\text{N'} \\
\text{AP} \\
\text{A} \\
\text{schnelle} \\
\text{N'} \\
\text{N} \\
\text{V} \\
\text{erarbeitung} \\
\text{DP} \\
\text{der Daten}
\end{array}
\]

\[
\text{(15)} \quad \begin{array}{l}
\text{a. } [\text{schnell}] = \lambda x. \text{fast}'(x) \\
\text{b. } [\text{verarbeit}] = \text{process}' \\
\text{c. } [\text{Daten}] = \lambda x. \text{data}'(x) \\
\text{d. } [\text{die}] = \lambda Q \lambda P \exists x. [Q(x)] \land P(x) \quad \text{9}
\end{array}
\]

The anti-iconic effect in case of internal modification strikes as being very similar to the paradox with agentive nouns discussed by Egg. In order to make his proposal work here, the semantics of the eventive affix *-ung* has to be appropriately defined. Most importantly, its semantics must assure two different landing sites the modifier can pertain to. In case of *-er*, these landing sites, i.e. agent and event, were easy to detect due to their obvious ontological difference. The situation with eventive affixes is more intricate since *-ung* does not pick up a thematic argument but relates to the underlying verbal event itself. What I propose is the following:

\[
\text{(16)} \quad \begin{array}{l}
\text{a. } \text{main fragment: } \lambda P \lambda e. e \approx \lambda E. P(E) \\
\text{b. } \text{secondary fragment: } \lambda P \lambda x \lambda e. \text{theme}'(e, x) \land P(e)
\end{array}
\]

According to the given proposal, the semantic contribution of *-ung* is split into a main and a secondary fragment. The main fragment entails a bipartite eventive structure. Small *e* represents the nominal event argument which is associated with a big *E* variable that stands for an event concept described by the verbal stem. This move presumes a specific perspective on the relation between verbal predicates and their eventive nominalizations. There are two conceivable positions: according to the first, nominalized predicates contribute the identical predicate to logical form as the underlying verbal predicate does, cf. e.g. Parsons (1990). Semantically, *-ung* would merely uncover the silent verbal event argument. The second position instead assumes that nominalized predicates contribute an individual term which is merely correlated with the underlying

---

\[9\text{This abbreviates Montague’s denotation for the definite determiner } \lambda Q \lambda P \exists x [\forall y [Q(y) \leftrightarrow y = x]] \land P(x)].\text{ Plural is ignored.}\]
verbal predicate, i.e. nominalizations contribute a concept-correlate in Fregean terms, cf. e.g. Cocciarella (1996). The main fragment given above implements the second stance: \( e \) symbolizes the nominal concept-correlate, the underlying verbal concept describes \( E \) and \( \approx \) stands for their link to each other.\(^{10}\) -ung thus introduces a new event argument embedding the verbally given eventive concept. Crucially, such bipartite structure provides two possible targets for modifiers: if the modifier applies to the underlying concept \( E \), it is \( l \)-related and thus to be read internally. If it applies to the nominal \( e \), it is \( e \)-related and hence externally interpreted. The task will be to show how these landing sites can be systematically predicted.

The secondary fragment of -ung takes care of the adequate integration of the verbal base it takes. Importantly, I presuppose a Neo-Davidsonian approach (cf. Parsons 1990) in order to conceive of verbs as denoting properties of eventualities with thematic roles being referred to by additional conjuncts. This spares taking along potential verbal arguments throughout the whole computation; instead, it allows for making arguments available by the characteristics of specific affixes. The proposal in (16-b) thus reads as follows: First, -ung binds a property of eventualities \( P \), regardless of the amount of thematic arguments. Second, -ung influences the secondary fragment of the emerging nominalization by introducing the theme argument potentially associated with the verbal base, i.e. the verbal theme argument is made available for binding by a subsequent DP argument.\(^{11}\)

In order to derive the meaning of Verarbeitung (‘processing’) from the lexically given verbal base and affix, a suitable rule for the interface between morphology and semantics has to be specified, cf. (17):

\[
\begin{align*}
&\begin{array}{l}
[\text{x B$\mathfrak{s}$ Aff}] \xrightarrow{\text{morph}} [X]: [Aff](\square) \\
[X_s]: \hat{[Aff_s]}([B\mathfrak{s}])
\end{array}
\end{align*}
\]

This MSI-rule retains basic intuitions of the MSI-rule already given in Egg (2006): specifically, affixes are assumed to be functions taking stems as arguments; furthermore, by introducing a yet undetermined hole in the main fragment, the rule ensures the semantic flexibility that is needed for computing the attested scopal interaction with modifiers. Other than the MSI-rule in Egg (2006), (17) is a bit simpler in not explicitly \( \lambda \)-binding thematic arguments of the base in the main fragment. The way thematic arguments are integrated is thus left to the semantics of the affixes themselves.

The ingredients set forth so far yield the following representation for Verarbeitung (‘processing’) via insertion and \( \lambda \)-conversion:

\[
\begin{align*}
\text{(18) a. } & [\text{n}]: \lambda P\lambda e. e \approx \lambda E. P(E)(\square) \\
& [n_s]: \hat{\lambda P\lambda y. \lambda e. P(e) \land \text{themo}'(e, y)](\text{process}')
\end{align*}
\]

\[
\begin{align*}
\text{b. } & = [\text{n}]: \lambda e. e \approx \lambda E. \square (E) \\
& [n_s]: \hat{\lambda y. \lambda e. \text{process}'(e) \land \text{themo}'(e, y)}
\end{align*}
\]

\(^{10}\)It is not trivial to appropriately define the relation \( \approx \). For the present purpose, I rely on a merely intuitive grasp: \( e \) instantiates an \( E \) being characterized by the underlying verbal eventuality property \( P \).

\(^{11}\)I assume that -ung does not introduce the verbal agent; but nothing essential hinges on that.
According to representation (18-b), *Verarbeitung* denotes a set of concept-correlates which are characterized by a set of event concepts. These event concepts are determined as processing events with an open position for a theme argument. The given constraint is underspecified in that there is a dominance relation between the two fragments allowing the integration of additional material in its solutions.

The next step comprises the integration of the DP argument *der Daten* (‘of the data’). The following SSI-rule for complementation is a category-independent generalization of the rule for verbal DP arguments given in Egg (2005):

\[
\begin{align*}
&\text{(19)} & [\bar{x} \times \text{DP}] \quad \xrightarrow{\text{SSI}} \quad [\bar{x}]: [\text{DP}]: [\bar{x}_S]: [[\text{DP}_S]]
\end{align*}
\]

The DP semantics in Egg’s framework rests upon standard assumptions about the lexical meaning of the respective D head as generalized quantifier. However, their semantic contribution is split into a secondary fragment that is identified with the bound variable and a fragment above that codes the quantificational information. The lexical entries (ignoring plural) are repeated in (20), (21) cites the SSI-rule needed (cf. Egg 2009), and (22) provides the corresponding computation:

\[
\begin{align*}
&\text{(20)} \hspace{1cm} \text{a. } [\text{die}] = \lambda Q \lambda P \exists! x.[Q(x)] \wedge P(x) \\
&\quad \text{b. } [\text{Daten}] = \lambda x.\text{data}'(x)
\end{align*}
\]

\[
\begin{align*}
&\text{(21)} \hspace{1cm} [\text{DP D NP}] \quad \xrightarrow{\text{SSI}} \quad [\text{DP}] : [D][\text{NP}](\lambda z. \Box) \\
&\quad \text{[DP}_S] : \bar{x}
\end{align*}
\]

\[
\begin{align*}
&\text{(22)} \hspace{1cm} \text{a. } [\text{DP}] : [\lambda Q \lambda P \exists! x.[Q(x)] \wedge P(x)](\lambda y.\text{data}'(y))(\lambda z. \Box) \\
&\quad = [\text{DP}] : [\lambda P \exists! x.[\text{data}'(x)] \wedge P(x)](\lambda z. \Box) \\
&\quad \text{b. } = [\text{DP}] : \exists x.[\text{data}'(x)] \wedge \Box \\
&\quad \text{[DP}_S] : \bar{x}
\end{align*}
\]

Putting pieces together according to (19), i.e. applying the semantics of *Verarbeitung* in (18-b) to the DP meaning in (22), yields the following constraint for *Verarbeitung der Daten* (‘processing of the data’):

\[
\begin{align*}
&\text{(23)} \hspace{1cm} \lambda e. e \approx \lambda E. \Box(E) \\
&\quad [\bar{n}] : \lambda e \exists! x.[\text{data}'(x)] \wedge \Box (e) \\
&\quad \text{[n}_S] : \lambda e. \text{process}'(e) \wedge \text{theme}'(e, x)
\end{align*}
\]

The secondary fragment $[\text{n}_S]$ fixes $x$ as the theme argument via $\lambda$-conversion; the main fragment $[[n]]$ is identified with $[[\text{DP}]]$. Additionally, the DP semantics introduce a new $\lambda$-abstracted $e$; this is necessary for providing event variables at the very top of the final representation.\textsuperscript{12} The affix information on the left remains unaffected.

\textsuperscript{12}This is parallel to the sentential level where adverbials and DPs introduce event variables, needed e.g. for the integration of tempus. For an appropriate typing of event variables see below.
The next step consists of the modifier’s integration. Egg (2006) proposes the SSI-rule (24):  

\[ \lambda x. [\text{Mod}](x) \land \Box (x) : [x_1] : [x_2] \]

The idea behind reads as follows: the main fragment of the modifie is inherited by the main fragment of the new complex constituent without any change. The new secondary fragment though integrates the modifier: a hole is applied to the same variable \(x\) as the modifier fragment is. Furthermore, this hole dominates the original secondary fragment of the modifie. Crucially, whereas both main and secondary fragment of the resultant constituent hence dominate the modifie’s original secondary fragment, their scopal interaction with each other is not determined.

Applying (24) to \(\text{\"{n} schnelle Verarbeitung der Daten}\) (‘fast processing of the data’) yields (25); finally, Egg’s SSI-rule for phrasal completion given in (26) generates the complete diamond in (27) for the full NP:  

\[ \lambda e. e \land \Box (e) : \lambda y. \Box (y) \land \text{fast}^\prime (y) \]

\(\lambda e. \text{theme}^\prime (e, x) \land \text{process}^\prime (e)\)

\[ [\text{NP}] : \Box \]

|[\text{XP}] : [x] | [\text{XP}] : [x] | [\text{NP}] : [x] | [\text{NP}] : [x] |

| [\text{NP}] : [x] | [\text{NP}] : [x] | [\text{NP}] : [x] | [\text{NP}] : [x] |

| [\text{NP}] : [x] | [\text{NP}] : [x] | [\text{NP}] : [x] | [\text{NP}] : [x] |

How many solutions, i.e. readings, does this diamond have? In principle, there are 3! (= 6) solutions. However, there seem to be only two readings empirically attested (i.e. the internal vs. the external one). Since this flexibility concerns the fragments coding the meaning of the affix and the modifier, it seems reasonable to block on principled grounds the scopal interaction with the information for the complement DP. In Egg (2006), certain unwanted ambiguities are suppressed by taking advantage of the fact that holes are typed, i.e. not compatible with random fragments but only with those matching type-theoretically. This aspect of semantic construction paves way for blocking in case of (27). The idea is to type the different event variables: I assume that verb semantics (on a par with adverbials) introduce event variables maximally flexible, i.e. a general event type \(e_g\) comprising all other types. However, whereas the inner structure of event nominalizations introduce a variable \(E\) for event concepts, the DP semantics is assumed to

---

13 The version cited rests upon intersective modification as discussed e.g. in Higginbotham (1985). Adjectives are thus of type \((e, t)\). Egg prefers a version based on functional application with adjectives typed \(\langle (e, t), (e, t)\rangle\). The choice between these options is irrelevant here.

14 The top hole supports possible ambiguities between the fragments below, cf. Egg (2006).
introduce variables $e$ for concept-correlates.\footnote{Admittedly, such typing is a stipulation. One might argue that DP semantics and nominal concept-correlates are compatible because both are nominal; however, note that at the sentential level, DP arguments must also be compatible with the event argument introduced by the verb.} With $e$ and $E$ being incompatible with each other, such typing rules out any solution where the fragment on the left – coding the DP semantics – must be identified with the hole in the central fragment. For this hole takes an $E$ type variable. Accordingly, three of six possible solutions are ruled out, specifically those where the affix fragment takes scope over the DP fragment.

There are three well-formed solutions left: let us first look at those two cases where the DP fragment on the left gets widest scope, i.e. is identified with the top hole. The subsequent computation can take two directions: either one first plugs in the affix fragment and then the modifier’s fragment or one starts out the other way round, cf. the results (28-a) versus (28-b) after $\lambda$-conversion:

\begin{align*}
(28) \quad & \lambda e \exists x. [\text{data}'(x)] \land \exists! x. [\text{data}'(x)] \land \lambda E . \text{theme}'(E, x) \land \text{process}'(E) \land \text{fast}'(E) \\
& \lambda e \exists x. [\text{data}'(x)] \land \exists! x. [\text{data}'(x)] \land \lambda E . \text{theme}'(E, x) \land \text{process}'(E) \land \text{fast}'(e)
\end{align*}

These are exactly those readings aimed at: in (28-a), the modifier pertains to the event concept, thus leading to an internal modification. In (28-b) though, it has wide scope over the concept-correlate, thus displaying the holistic external reading.

What about the third solution compliant to types? It is achieved by first identifying the modifier fragment with the top, then integrating the DP semantics and finally plugging in the affix fragment, cf. (29):

\begin{align*}
(29) \quad & \lambda y \exists x. [\text{data}'(x)] \land \exists! x. [\text{data}'(x)] \land \lambda E . \text{theme}'(E, x) \land \text{process}'(E) \land \text{fast}'(y)
\end{align*}

This final third representation is identical to the one for the external reading in (28-b); hence it is not at odds with the empirical evidence for merely two readings.

3 Scopally underspecified locatives

Locative PP modifiers are another instance of the contrast between internal and external modification. As in case of AP modifiers, internally interpreted locatives pose a problem for a 1:1 mapping between c-command and scope since they surface in distance to their modifie, cf. repeated from above (30):

\begin{align*}
(30) \quad & \text{die Zubereitung des Huhns in einer Pfeffersauce} \\
& \text{the preparation the chicken$_{GEN}$ in a pepper-sauce}
\end{align*}

Construing a constraint according to the rules and the procedure above yields diamond (31). It simplifies DP semantics in representing the DP argument as a $\iota$-term and the PP as a simple predicate. (32) lists the constraint’s solutions.
In the external reading, i.e. (32-a), the preparation event as a whole is localized in the pepper sauce. This is pragmatically deviant but otherwise unproblematic. The internal reading is not that straightforward: according to (32-b), the locative applies to the event concept E. This suits the intuition that an internal locative somehow modifies the conceptually specified inner event structure. However, it remains unclear what such localization of the conceptual essence exactly amounts to. Particularly, one has to assure that, finally, it is the chicken that is localized in the pepper sauce. In order to tackle this problem more precisely, I will first sketch Maienborn (2003)’s proposal for corresponding adverbial locatives and then transfer her solution to the nominal case at hand.

Maienborn proposes an abstract modification template MOD* which is accompanied by a structural condition, cf. (33):

\[
\lambda Q \lambda P \lambda x [P(x) \& R(x,v) \& Q(v)]
\]

Condition: if MOD* applies to categorial type X, \( R = \text{part-of} \), otherwise (i.e. in an XP-environment) \( R \) is the identity function.

MOD* conforms to common analyses of intersective modification by mapping two properties instantiated by the meaning of modifier and modific to a conjunction of corresponding predicates. However, it additionally introduces a free relation variable mediating between the resultant predicates. Crucially, its interpretation is conditioned structurally and thus compositional in nature. Applying MOD* to the adverbials in (34-a) vs. (34-b) leads to the respective representations in (35).

(34) a. \([VP [pp \text{in einer Küche}]} [VP \text{das Huhn zubereiten}]\)  
   \([VP [pp \text{in a kitchen}]} [VP \text{the chicken prepare}]\)  
   b. \([VP \text{das Huhn [v [pp \text{in einer Pfeffersauce}]} [v \text{zubereiten}]\} [VP \text{the chicken [v [pp \text{in a pepper-sauce}]} [v \text{prepare}]\)\]

(35) a. \(\lambda e. \text{prepare}'(e) \& \text{theme}'(e, \text{tx.chicken}'(x)) \& \text{in}'(e,K)\)  
   b. \(\lambda e. \text{prepare}'(e) \& \text{theme}'(e, \text{tx.chicken}'(x)) \& \text{part-of}'(e,v) \& \text{in}'(v,P)\)

The locative’s projection above the VP triggers the identity function for the relation variable and thus yields an external modification with the event as a whole being localized in the kitchen. On the contrary, the interpretation for internal locatives, projected in V-adjacent position, is bound to a mediating variable \( v \): \( v \) is localized in the pepper-sauce and \( \text{part-of} \) identifies \( v \) as integral to \( e \). Whereas this integrity constraint relies upon semantics, the particular value for \( v \) is fixed at the conceptual level, thus not part of compositional semantics proper. In the case at hand, the most plausible candidate for \( v \) is
the chicken; in effect, this leads to the desired interpretation with the chicken referent localized in the peppersauce.\footnote{Maienborn builds upon ‘Two-Level Semantics’ as advanced in Bierwisch (1982) and subsequent related work. Thus she distinguishes the grammatically determined semantic form of a linguistic expression from its conceptual structure being fixed by world-knowledge and context.}

A straightforward transfer to the case at hand is impeded by the fact that internal versus external locatives are not distinguished by surface syntax. Assuming the very same structure for both readings, a truly compositional condition is trivially impossible. However, based upon the derivation along the lines of Egg’s interface rules, the different targets of locatives can be paired with respective event types. I thus reformulate \(\text{MOD}^*\) for the adnominal cases as follows:

\[
(36) \quad \text{MOD}^*: \lambda Q \lambda x [P(x) \& R(x, v) \& Q(v)]
\]

Condition: if the free variable relates to the verbal concept \(E\), \(R = \text{part-of}\); if it relates to the nominal concept-correlate \(e\), \(R\) is the identity function.

Such reformulation constrains the way locatives are integrated in terms of semantics alone. I do not consider it stipulative but rather intuitively conclusive: if the locative is related via \(v\) to the nominal event concept-correlate \(e\), i.e. a variable for concrete whole events, it ‘sees’ a potential target right from the start. Thus \(v\) and \(e\) are identified. On the contrary, the abstract verbal concept \(E\) is not a conceivable candidate to be localized. Thus it turns out to be necessary to infer an integral part to such a concept that could be a plausible target for localization.

Building (36) into the modificational analysis from above yields the following representations for external vs. internal locatives:

\[
(37) \quad \begin{align*}
\lambda e \cdot & \in'(v, P) \& R(e, v) \& e \approx \lambda E \cdot \text{theme}'(E, \text{t.x.chicken}'(x)) \\
& \text{prepare}'(E) \\
\lambda e \cdot & \approx \lambda E \cdot \text{prepare}'(E) \& R(E, v) \& \in'(v, P) \\
& \text{theme}'(E, \text{t.x.chicken}'(x)) \\
\lambda e \cdot & \approx \lambda E \cdot \text{prepare}'(E) \& \text{part-of}'(E, v) \& \in'(v, P) \\
& \text{theme}'(E, \text{t.x.chicken}'(x))
\end{align*}
\]

The results (37-b) and (38-b) suit the intuitively given readings for \textit{Zubereitung des Huhns in einer Pfeffersauce} (‘preparation of the chicken in the pepper sauce’).\footnote{To be sure, as before the pragmatic nonsense of external modification in this case is neglected.} Pragmatically, the internal reading can be strengthened by identifying \(v\) and the referent for the chicken, cf. (38-c).\footnote{One might ask if a free choice between \textit{identity} and \textit{part-of} for \(R\) would do the same job as the condition in (36). In terms of the given proposal, it would cause two additional readings:}

\[
(38) \quad \begin{align*}
\lambda e \cdot & \approx \lambda E \cdot \text{prepare}'(E) \& \text{in}'(\text{t.x.chicken}'(x), P) \\
& \text{theme}'(E, \text{t.x.chicken}'(x))
\end{align*}
\]

\(\text{(i) } \begin{align*}
& \text{a. ‘an entity } v \text{ being integral to the concept-correlate } e \text{ is located in the pepper-sauce’} \\
& \text{b. ‘the event concept } E \text{ is localized in the pepper-sauce’}
\end{align*}\)
As mentioned, the given computation for locatives simplifies DP semantics. There is no harm in simple cases. However, examples with interacting quantifiers as (39) having the readings in (40) enforce a more involved analysis:

(39) die Zubereitung aller Hühner in einer Pfeffersauce
the preparation all chicken in a pepper-sauce

(40) a. internal with $\exists > \forall$ ‘there is a pepper-sauce in which all chicken are prepared’
b. internal with $\forall > \exists$ ‘for all chicken there is some pepper-sauce in which they are prepared’
c. external with $\exists > \forall$ ‘there is a pepper-sauce in which the preparation of all chicken takes place’
d. external with $\forall > \exists$ ‘for all chicken there is some pepper-sauce such that the preparation of these takes place in it’

One might ask if the sketched mechanism can predict exactly these readings.19

Adding the quantificational force of DPs to the constraint leads to the diamond (41). I omit the free variable for the locative’s integration in order to facilitate readability:

(41) \[
\begin{array}{c}
\square \\
\lambda e \exists p. \text{pepper-sauce}'(p) \land \square(e) \\
\lambda e \forall h. \text{chicken}'(h) \rightarrow \square(e) \\
\lambda e, e \approx \lambda E \square(E) \\
\lambda x. \square(x) \land \text{in}'(x, p) \\
\lambda e_g. \text{theme}'(e_g, h) \land \text{prepare}'(e_g)
\end{array}
\]

Taking into account that the embedded event concept of type $E$ is incompatible with the $e$ introduced by the DP semantics, (41) has four solutions, cf. (42):20

---

19Interestingly, at the sentential level a quantifying internal modifier can scope out notwithstanding the assumed base position next to V, cf. (i) with both ‘$\forall > \exists$’- and ‘$\exists > \forall$’-reading:

(i) Er hat alle Hühner in einer Pfeffersauce zubereitet.
He has all chicken in a pepper-sauce prepared

20Most importantly, the $\lambda$-term for the affix in the middle is not allowed to have wide scope over any DP $e$, i.e. the identification with the top has to first process both quantifier fragments. There are four instead of merely two readings because the PP’s semantic contribution – being coded within the two separate $\lambda$-terms on the right hand side – can go up as a whole or as separate constraints. If they are identified with the top together, the two external readings are generated; if they are kept apart, the internal readings are built up.
These are (if supplemented by the free variable account for locatives) exactly those four readings empirically attested.

4 Conclusion and Outlook

The present paper addressed the challenge that AP and PP modifiers to eventive ungnominalizations trigger – besides straightforward event external readings – event internal interpretations not expected by isomorphically mapping surface-oriented c-command on semantic scope. By applying Egg’s flexible syntax-semantic interface built upon underspecification to the cases under discussion, both internal and external readings could be derived in a principled compositional manner without resorting to some form of syntactic preprocessing.

Crucially, the analysis relies on a bipartite eventive structure for ungnominalizations: the affix introduces a secondary eventive concept-correlate $e$ being related via $\approx$ to a lexically determined event concept argument $E$ that is fed by the verbal base. This split provides two targets for the modification: whereas external modifiers apply to $e$ and thereby trigger the holistic event modification, internal modifiers apply to $E$ and thus specify event concepts from inside. Supplementary to such landing site ambiguity, the additional flexibility observed for internal locative PP modifiers is captured by introducing a free variable to be instantiated on conceptual grounds.

The most obvious follow-up question in view of the proposed analysis is if it covers other event nominals. Particularly, nominalized infinitives show the same flexibility as ung-derivations do although they lack an overt nominal affix, cf. (43):

(43) das schnelle Verarbeiten der Daten
the fast process$_{nominal}$ the data$_{GEN}$

One thus might ask more generally whether there is any other evidence for the assumption that event nominals have a bipartite eventive structure. In other words: it must be shown independently that event nominals do not simply render the verbal event argument visible but trigger some sort of secondary reifying process.

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References


Embedding Imperatives in English

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Abstract
Although it has generally been claimed otherwise (cf. Katz and Postal 1964, Sadock and Zwicky 1985, Palmer 1986, Rivero and Terzi 1995, Platzack and Rosengren 1998, Han 1998 among others), it holds that embedded imperatives exist in English. We describe their main characteristics and provide an account of these by relying on Schwager’s (2006) propositional analysis of imperatives, where imperatives are treated as modalized sentences. The imperative modal is thereby relativized to eventualities (cf. Hacquard 2006).

1 Introduction
It has been claimed that imperatives cannot be embedded in English (cf. Katz and Postal 1964, Sadock and Zwicky 1985, Palmer 1986, Rivero and Terzi 1995, Platzack and Rosengren 1998, Han 1998, among others). This claim has been motivated in at least two distinct ways: by treating imperatives as inherent speech act objects which resist embedding on conceptual grounds (cf. Han 1998), and by taking paradigms like (1) as conclusive empirical evidence against their embeddability (cf. Sadock and Zwicky 1985, Palmer 1986 and others). (1a) and (1b) show that declarative and interrogative clauses can occur as complements of attitude verbs, while (1c) purportedly shows this not to be the case for imperative clauses.

(1)  a. John claimed that [Mary sang]
    b. John knows [what Mary sang]
    c. *John said that [call Mary]

Both arguments against there being embedded imperatives in English are based on questionable premises. On the one hand, the paradigm in (1) is misleading. We should rather take the sentence in (2), where the complement of the intensional verb lacks an overt complementizer, as the indicative example. On the other hand, the assumptions that imperatives are essentially speech act objects and that such objects cannot be
arguments of attitude verbs – namely, that attitude verbs do not select for illocutionary acts – have independently been argued to be unwarranted (cf. Schwager 2006).

(2) John said [call Mary]

The theoretical import of the existence of embedded imperatives is evident. Namely, theories of imperatives that predict their unembeddability need to be modified to accommodate (2) and similar data, while theories that predict such embeddings receive empirical support. Furthermore, if embedded imperatives exist, we can study their semantic contribution to the interpretation of the structures containing them in order to (i) get at a proper analysis of imperatives in general, embedded and matrix, as well as (ii) gain new insights about the nature of the embedding verbs. In this respect, the understanding garnered by the existence and the nature of embedded imperatives should be utilized in a way that insights about embedded interrogatives were (Karttunen 1977).

The paper is organized as follows: Section 2 presents evidence that embedded imperatives are neither quotations nor elliptical to-infinitives and that the embedding verb is not used parenthetically. Section 3 compares felicity conditions on embedded and matrix imperatives. Section 4 describes analogous behavior of epistemic modals and provides an analysis for it. Section 5 introduces a theory of imperatives according to which they are modalized sentences. Section 6 provides an account for the parallelism observed between embedded and matrix imperatives by combining the insights of sections 4 and 5. Section 7 points out some issues for further research, while Section 8 concludes.

2 Imperatives as complements of attitude verbs

The sentence in (2) raises several questions related to the nature of the obligatory absence of an overt complementizer, the markedness of parallel sentences with other intensional verbs (3), and the reference of the imperative subject. However, before these questions may be addressed, it must first be shown that (2) is indeed an example of an embedded imperative and not a quoted imperative. This is achieved by showing that, unlike quotes, the string resembling an embedded imperative in (2) and similar examples is not grammatically opaque. Subsequently, we provide evidence that the embedded imperative is also not a bare infinitive, and that Mary said is not a parenthetical.

(3) a. *John claimed (that) [call Mary]  
b. *John knows (that) [call Mary]

The standard tests for determining whether certain seemingly embedded clauses are quotations (cf. Anand 2006 and others) involve checking for felicitous occurrences of demonstratives, clause-external variable binding, association with external focus-sensitive operators, wh-extraction, external licensing of negative
polarity items, and (non-)interaction of clause-external and clause–internal nominals with respect to binding. If what we have characterized as embedded imperatives pass these tests, this can be taken as an indication that we are dealing with indirect speech.

The facts strongly suggest that embedded imperatives are grammatically transparent. The first relevant datum is the contrast in (4). We see that in (4a), John and his can be corefential, whereas in (4b), where it is clear that the pronoun his is contained in a quote, the coreference reading is marked due to the unlikelihood that John would refer to himself with a third person pronoun.

(4) a. John said call his mom
   b. #John said: "Hey, call his mom"

The data in (5) is related. In a situation where the examples in (5) are uttered and the respective indexical that is accompanied by a pointing gesture, (5a) but not (5b) is felicitous. Namely, if an indexical is inside a quotation, it should not be evaluated with respect to the utterance situation of (5b) but with respect to the situation of John’s original utterance. The pointing gesture would thus be misplaced. Accordingly, the contrast in acceptability in (5) is an indication that the sentence in (5a) is an instance of indirect speech and does not contain a quotation.

(5) Speaker points at a book
   a. John said buy that book
   b. #John said: "Hey, buy that book"

Furthermore, focus-sensitive adverbs like only are able to associate with focused elements inside the complement of say: (6a) conveys that the only thing that John said that you should give to his mom is roses. (6b) cannot convey this, nor does it have a metalinguistic reading in which there is quantification over parts of the quotation.

(6) a. John only said give rosesF to his mom
   b. #John only said: "Hey, give rosesF to his mom"

The same reasoning applies to examples in (7) as well: In (7a) we see that a variable contained in the complement of say may be bound by a quantifier external to it; in (7b) we see that wh-extraction out of the complement of say is not ill-formed; and in (7c) it is shown that the licenser of an NPI inside the complement of the attitude verb does not have to be its immediate clausemate. All of these facts corroborate that the construction studied here allows for syntactic interaction with the rest of the clause and can appropriately be characterized as an embedded imperative.

(7) a. Every professor said buy his book
   b. ‘Who did John say call at three?
   c. ‘No one said buy anything
Furthermore, sentences containing embedded imperatives may be arguments of further attitude verbs (8). Along with the data introduced above, this is an indication that the cases of embedded imperatives do not involve parenthesis (cf. McCloskey 2006).

(8) John thought Mary said call her mom

Finally, it cannot be claimed that the imperative clauses under discussion are actually to-infinitives in which the auxiliary has been elided: In (9) we see that although past participles may occur in to-infinitives, they are illicit in the constructions studied here. In (10) we see that negated to-infinitives cannot be the source of negative embedded imperatives.

(9) a. John said to have called his mom by tomorrow
    b. *John said have called his mom by tomorrow

(10) a. John said not to call his mom
    b. *John said not call his mom
    c. John said don’t call his mom

In this section it was conclusively shown that imperatives can be embedded in English. In particular, we have shown that the respective constructions do not share the characterizing properties of quotations, parentheticals and elliptical to-infinitives. However, embedded imperatives also differ in certain respects from embedded declaratives and interrogatives: the former are subject to certain felicity conditions that the latter two are not. These constraints will be exemplified in the next section.

3 Matrix and embedded imperatives

The use of matrix imperatives is subject to a different set of constraints than the use of declaratives and interrogatives. Embedded imperatives are restricted in a similar manner. The constraints involve primarily the authority status of the speaker, her epistemic state, and her approval of what is commanded by the imperative1. Between them, they condition the performative nature of the imperative (Schwager 2006). Now, it clearly holds that the performativity of imperatives does not disappear with embedding under an attitude verb: a felicitous use of an embedded imperative is conditional on the reported utterance having been performative. This is illustrated by the contrast between (11a), in which the reported utterance solely described a state of affairs, and (11b), in which the reported utterance was performative. The performativity of the embedded imperative is thereby not anchored to the actual speech context but to the speech context of the reported utterance.

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1 In this paper, the focus will be on the command reading of imperatives. All the observations as well as the proposed analysis holds for other readings (wish, advice etc.) of imperatives as well.
Embedding Imperatives in English

(11) a. John to Sue: "Peter has an obligation to call Mary"
    Sue to Peter: #John said call Mary
b. John to Sue: "I hereby order that Peter call Mary"
    Sue to Peter: John said call Mary

Building on the fact that the performative nature of imperatives is conserved under embedding, an entire class of similarities between matrix and embedded imperatives can be derived. In (12a), it is illustrated that a matrix imperative cannot be followed by a statement that negates the truthfulness of the person who utters the imperative. In (12b), the infelicity stems from negating the truthfulness of the person whose performative utterance is being reported. A shift in the locus of the explanation of the markedness of discourses in (12) can be observed: the locus in (12a) was in contradicting the actual speaker, while in (12b) it was in contradicting the subject of the attitude verb.

(12) a. A: Call Mary right away! B: #That's not true
b. A: John said call Mary right away! B: #John lied

A similar reasoning applies to (13) and (14). In (13a), we see that it is infelicitous for the speaker to be certain that her addressee will call Mary independently of the utterance of the imperative and still command it; in (13b) it is the epistemic state of the subject of the attitude verb that is responsible for the markedness of the respective discourse. In (14a), it can be seen that it is infelicitous for the speaker to command something that she does not consider to be a good outcome; in (14b), the infelicity is due to subject of the attitude verb having had such considerations.

(13) a. #I know you're going to call Mary. Call her!
    b. #John knew you were going to call Mary. He said call her
(14) a. #Call Mary right away. But I don't think you should
    b. #John said call Mary right away. But he didn't think you should

To summarize: certain parallels hold between the infelicitous use of embedded and matrix imperatives. The intuitive reason for the markedness of the (a) sentences in (12)-(14) is that there is a conflict between the imperative uttered by the agent of the actual speech event and the accompanying context (cf. Schwager 2006). The markedness of (b) sentences, on the other hand, is due to a conflict between the imperative uttered by the agent of the reported speech event and the context of that speech event. Thus, while the explanations of the markedness of discourses in (a) and (b) have the same underlying architecture, the ingredients are distinct – in (a) examples, the ingredients are the circumstances of the actual speech event, while in (b) examples, the ingredients are the circumstances of the reported speech event. A similar pattern has been noted in the evaluation of epistemic modals, to which we turn in the next section.
4 Matrix and embedded epistemic modals

Epistemic modality is context-sensitive (Hacquard 2006, Stephenson 2007, Yalcin 2007 and many others), i.e. it depends on the context whose epistemic state is relevant for determining the sentence’s truth conditions. In particular, the epistemic agents that feature in the assessment of matrix epistemics (15a) come from the actual speech context, while the epistemic agents featured in the assessment of embedded epistemic modals are determined by the context of the reported attitude situation (15b). For the purposes of this paper, we assume that the knowledge that is relevant for matrix epistemic modals is that of the speaker (cf. DeRose 1991, Stephenson 2007, MacFarlane 2008 for a more sophisticated treatment and caveats), while the knowledge that is relevant for embedded epistemic modals is that of the subject of the respective attitude verb. This is illustrated by the paraphrases in (15a’) and (15b’).

(15)

a. It might be raining
   a’. It’s not the case that I know that it isn’t raining
   b. John believes that it might be raining
   b’. It’s not the case that John knows that it isn’t raining

As an illustration, these assumptions provide a natural explanation of the infelicity found in epistemic contradictions (cf. Yalcin 2007 for discussion): since the epistemic modal is evaluated in relation to her knowledge, by uttering (16a) the speaker is being cognitively dissonant. The markedness of (16b) is due to cognitive dissonance being attributed to the subject of the attitude verb.

(16)

a. #It’s raining and it might not be raining
   b. #John believes it’s raining. He also believes that it might not be raining

It is clear that an unmodified Kratzer (1978) approach does not capture this context-sensitivity: *John believes that it might be raining* is true according to that theory iff, roughly, in all the worlds w doxastically accessible to John, at least one world w’ is epistemically accessible from w in which it is raining – there is no mention of whose epistemic state is relevant in determining the latter accessible worlds. Several different types of accounts of epistemic modals have been proposed that try to remedy this shortcoming. Among them is also the event-relative approach in Hacquard (2006) that is based on Kratzer’s classical treatment of modality. Hacquard assumes that the first argument of a modal is an accessibility relation that assigns a set of accessible worlds to the modal’s second argument, an event; the modal’s third argument is a proposition. The denotation of *might* is given in (17).

(17) \[ [[\text{might R e}]] = \lambda p. \exists w \in R(e): p(w) = 1 \]

---

2 A slightly simplified version of Hacquard’s (2006) approach is presented here. The simplifications, which are primarily related to the treatment of root modality and tense, are harmless since we are dealing with ‘high’ modals, i.e. deontic addressee-oriented modals, and the role of tense is ignored.
The accessibility relation in (17) is epistemic and Hacquard proposes that it assigns to
an event a set of worlds compatible with the content of that event (18a). The content of
an event is thereby the set of propositions that are associated with the event in a certain
manner, e.g. they are known in the event(uality) (18b). The epistemic accessibility
relation thereby presupposes that its event argument is contentful.

(18)  
(a) \(R_{\text{epist}} = \lambda e: \text{CONTENT}(e) \neq \emptyset \). \(w. \) w is compatible with \(\text{CONTENT}(e)\)  
(b) \(\text{CONTENT} = \lambda e. \lambda p. p \) is known in e

Furthermore, Hacquard proposes that modals may merge either with a VP – i.e.
below tense and aspect – or T’ – i.e. above tense and aspect. They are then relativized
to the closest c-commanding event variable, which provides the temporal and
individual anchoring of the modal – namely anchoring to the time and the individual
participants of the event. In the case of unembedded modals that merge with T’, that
event is the speech event. In the case of embedded modals that merge with T’, that
event is the attitude event. In the cases of modals that merge with a VP, the event they
are relativized to is the event introduced by the aspect operator. This event-
relativization is formally captured by the event argument of the modal being bound by
the closest event-binder:

(19)  
Syntactic assumptions  
(a) Event and world variables are bound by the closest binders  
(b) \(\lambda w \)' and \(\lambda e \)' can be inserted freely to ensure interpretability

This system can account for the dependence of matrix epistemics on the
cognitive state of the speaker as well as the switch of dependence which occurs with
embedding of epistemic modals. It also provides a natural explanation for why
epistemic modals merge above aspect (and tense). Namely, their accessibility relation
selects for contentful events – speech and various attitude events are contentful, while
events in the denotation of most other VPs are not. Accordingly, merging the epistemic
modal with a VP, where the modal’s event argument is relativized to the event
introduced by aspect, would lead to a clash between the requirements of the
accessibility relation and the nature of the event argument (cf. Hacquard 2006 for more
details).

A simplified structure for matrix epistemics is given in (20). In (20b), instead
of binding the modal’s event argument, we represent the speech event with e* – a more
elaborate speech act projection likely dominates the structure in (20b) but will not
feature in our representations. We collapse the tense and aspect heads into Infl
complex, whose denotation is given in (20c); the semantic contribution of tense is
ignored.

(20)  
(a) John might come  
b. \([[\text{might} \: R \: e^*] \: [\lambda w \: \text{Infl} \: w] \: [\lambda e \: \text{John come}(e)]])  
c. \([[\text{Infl} \: w]] = \lambda P. \exists e \leq w[P(e) = 1]
The truth-conditions of (20b) are computed in (21): the minimal speech event of uttering (20a) has only the speaker as a participant. Accordingly, it is the speaker’s cognitive state that determines the epistemic content of the event, i.e. the domain of the first existential quantifier contains only those worlds that are compatible with the speaker’s knowledge. It is asserted that in at least one of those worlds, John comes.

\[(21) \quad [(20a)] = 1 \iff \exists w \in R_{\text{epist}}(e^*) \exists e \leq w [\text{agent}(e)(\text{John}) \& \text{come}(e)]\]

If an epistemic modal is embedded under an attitude verb, its event argument is co-indexed with the event(uality) argument of the attitude verb – they are both bound by the same event binder (22b). Accordingly, since the modal is relativized to the attitude event, it is the beliefs of the attitude holder that will be relevant in determining the accessible worlds. The holder of the attitude event is denoted by the subject of the attitude verb. Accordingly, the content of the event, which determines the domain of existential quantification over worlds, consists of the beliefs of the subject. This accounts for the observed shift in the epistemic agent relevant for evaluating epistemic modals from the speaker in (21) to the subject of the attitude verb in (22d).

\[(22) \quad \begin{align*}
a. \quad & \text{Mary believes that John might come} \\
b. \quad & [\text{Infl } w^*] \lambda e' [\text{Mary believe}(e') \lambda w' [\text{might } R e'] \lambda w [\text{Infl } w] [\lambda e [\text{John come}(e)]]] \\
c. \quad & [\text{believe}] = \lambda e. \lambda p. \lambda x. \text{holder}(e)(x) \& \text{believe}(e) \& \forall w \in \wedge \text{CONTENT}(e)[p(w) = 1] \\
d. \quad & [(22b)] = 1 \iff \exists e \leq w^* [\text{holder}(e)(\text{Mary}) \& \text{believe}(e) \& \forall w \in \wedge \text{CONTENT}(e)[\exists w^* \in R_{\text{epist}}(e)[\exists e' \leq w' [\text{agent}(e')(\text{John}) \& \text{come}(e')]]], \\
\text{i.e. iff } & \exists e \leq w^* [\text{holder}(e)(\text{Mary}) \& \text{believe}(e) \& \exists w \in R_{\text{epist}}(e)[\exists e' \leq w [\text{agent}(e')(\text{John}) \& \text{come}(e')]]] \\
\end{align*}\]

This section has illustrated some basic facts related to the context-sensitivity of epistemic modality. In particular, we have focused on the shift of the individual relevant for determining the possible worlds over which the modal quantifies; such a shift was shown to occur when epistemics are embedded under an attitude verb. An approach in which modals are relativized to events was adopted to account for these facts. The next section will introduce a modal semantics for imperatives. Combined with the event-relative treatment of modality, this will allow us to analyze the facts described in Section 3.

5 Imperatives as modalized sentences

There are several distinct approaches to semantics of imperatives (Han 1998, Schwager 2006, Portner 2007 among many others). These approaches differ in whether they predict embeddability of imperatives. In particular, if a standard analysis
of embedding attitude verbs – i.e. attitude verbs select for propositions – is adopted, approaches that assume that imperatives are not propositional cannot be maintained in light of the preceding discussion. However, if imperatives are treated as denoting modal propositions, their embedding is expected. Schwager’s (2006) semantics of imperatives exemplifies the second type of approach: she analyzes imperatives as performatively used deontic modal sentences. More precisely, imperatives and performative modals are treated as having the same assertive content as non-performative modals, but they additionally trigger three presuppositions.

An illustration of the first restriction on the use of imperatives and performatively used deontics is in (23). In (23a), it is shown that it is infelicitous to contest the verity of a performatively used deontic modal. The same observation was shown to hold for imperatives in (12a), repeated in (23b). The restriction can be characterized as the speaker possessing a rational authority which makes disputing her truthfulness infelicitous. This is the authority condition.

(23)  
a. A: You must call Mary right away! B: #That's not true  
b. A: Call Mary right away! B: #That's not true

The second presupposition triggered by imperatives and performative deontics is the following: prior to the utterance of the imperative, the speaker must not believe that the addressee will fulfill the obligation imposed by the imperative independently of the utterance of the imperative. She must not be convinced that her command will be ignored either. This is the epistemic uncertainty condition, and it is illustrated in (24) (cf. (13a) above).

(24)  
a. #I know you're (not) going to call Mary, (but) you must call her  
b. #I know you're (not) going to call Mary, (but) call her

The third presupposition is that the speaker must endorse what she commands. This is the accessibility relation affirmation condition (ordering source affirmation in Schwager 2006). Again, a parallelism between imperatives and performatively used modals obtains (25) (cf. (14a) above).

(25)  
a. #You must call Mary right away! But I don't think you should  
b. #Call Mary right away! But I don't think you should

The standard meaning of a universal modal is given in (26a); the LF of You must call Mary is in (26b). (26a) also represents the content of the assertive component of the imperative modal and the performative deontic modal must. In addition, both the imperative and the performative must select for a deontic accessibility relation that takes a contentful event of appropriate kind as its argument. They are also subject to the three conditions discussed above: the speaker has to be an authority in the speech.

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3 A sparse version of Schwager’s analysis is instrumentalized in this paper. Furthermore, some liberties are taken in formulating some points. For more details, cf. Schwager 2006.
event, she has to affirm the accessibility relation, and she must be epistemically uncertain in an event immediately preceding the speech event about whether the proposition denoted by the complement of the imperative modal would obtain. The denotation of the imperative modal is in (27a); the LF of Call Mary is in (27b). The truth-conditions of (27b) are computed in (27c).

(26)  a. \[
[[\text{must}]] = \lambda R.\ \lambda e.\ \lambda p.\ \forall w \in R(e): p(w) = 1
\]
b. \[
[\text{must } R\ e^*]\ [\lambda w\ [[\text{Infl } w]\ [\lambda e\ \text{[you call(e) Mary]]}]]
\]

(27)  a. \[
[[\text{imp}]] = \lambda R.\ \lambda e: \ \text{authority}(agent(e),e) \ \& \ \text{affirm}(agent(e),R,e).\ \lambda p:\ \text{uncertain}(agent(e),p,e_{\text{pre}}).\ \forall w \in R(e): p(w) = 1
\]
b. \[
\begin{array}{c}
\text{imp } R\ e^* \\
\lambda e \\
\lambda w \\
\text{Infl } w
\end{array}
\]
c. \[
[[\text{(27b)}]]\ \text{is defined only if the speaker is an authority, affirms the accessibility relation, and is epistemically uncertain about the addressee calling Mary. If defined, }[[\text{(27b)}]] = 1 \iff \forall w \in R(e^*) [\exists e \leq w [\text{agent}(e)(\text{the addressee}) \ \& \ \text{call}(e)(\text{Mary})]]
\]

The above representation leaves the domain of universal quantification underspecified. We will assume that this domain consists of worlds that are compatible with what was said in the respective speech event. That is, we propose that the imperative modal selects for the accessibility relation given in (28a). The natural content of a speech event is thereby the set of propositions that the speaker conveyed to an addressee by her utterance (28b).

(28)  a. \[
R_{\text{imp}} = \lambda e: \text{CONTENT'}(e) \neq \emptyset.\ \lambda w.\ w\ \text{is compatible with CONTENT}(e)
\]
b. \[
\text{CONTENT'} = \lambda e.\ \lambda p.\ p\ \text{was conveyed in } e
\]

This section introduced Schwager’s propositional analysis of imperatives and performative modals, which was transposed to an event-based framework introduced in Section 4. In particular, imperatives are clauses headed by a modal that has the same semantics as non-performative modals but is subject to three additional conditions that are encoded as presuppositions: authority, epistemic uncertainty and accessibility relation affirmation. The following section will combine the proposals introduced in the last two sections to derive the facts described in Section 3.
6 Shift with embedded imperatives

The imperative modal shares a crucial property with epistemic modals: it merges above aspect (27b). The reason for this is the same as the reason for high merger of epistemic modals: the imperative modal selects for contentful events which are due to local event co-indexation (19) not available if the modal merges with the VP. Consequently, if an imperative is embedded under an attitude verb, the event argument of the imperative modal is bound by the same event binder as the event argument of the attitude verb. This can be seen in (29b), which is the LF of the sentence in (29a). The meaning of say is given in (29c).

\[(29)\]
\[\begin{align*}
\text{a.} & \quad \text{John said call Mary} \\
\text{b.} & \quad \text{Infl } w^* \\
& \quad \lambda e' \\
& \quad \text{John} \\
& \quad \text{say}(e') \\
& \quad \lambda w' \\
& \quad \text{imp } R e' \\
& \quad \lambda w \\
& \quad \text{Infl } \lambda e \\
& \quad \text{you call}(e) \text{ Mary} \\
\end{align*}\]

\[\text{c. } [[\text{say}]] = \lambda e. \lambda p. \lambda x. \text{agent}(e)(x) \& \text{say}(e) \& \forall w \in \cap \text{CONTENT}(e)[p(w) = 1]\]

The imperative modal is thus anchored to the attitude event. Accordingly, this is the event that is subject to definedness conditions on imperatives discussed in Section 5, i.e. the authority, epistemic uncertainty and accessibility relation affirmation conditions. Since the agent of the attitude event is denoted by the subject of the attitude verb, it is the authority status, epistemic state and affirmative stances of this individual that the felicity of the embedded imperative depends on. This is exemplified in (30) where the truth-conditions of (29b) are computed.

\[(30)\] If defined, \[[((29b))] = 1 \text{ iff } \exists e \leq w^*[\text{agent}(e)(John) \& \text{say}(e) \& \forall w \in \cap \text{CONTENT}(e)[\forall w' \in \text{R}_{\text{imp}}(e)[\exists e' \leq w'[\text{agent}(e')(\text{the.addr.)} \& \text{call}(e')(\text{Mary})]]]] \text{ iff } \exists e \leq w^*[\text{agent}(e)(John) \& \text{say}(e) \& \forall w \in \text{R}_{\text{imp}}(e)[\exists e' \leq w' [\text{agent}(e')(\text{the.addr.)} \& \text{call}(e')(\text{Mary})]]]].

\[[((29b))] \text{ is defined only if in the reported speech event, John is an authority, he is uncertain about the addressee calling Mary and affirms the addressee calling Mary.}\]
These truth-conditions are accountable for the patterns observed in Section 3, repeated in (31). Namely, the operative condition responsible for the markedness of (31a) is John having to be an authority in the reported saying event. The second sentence of (31a) contradicts this condition. In (31b), the first sentence expresses that prior to uttering the imperative, John was epistemically certain about the addressee calling Mary. The use of an embedded imperative in the second sentence, however, comes with the precondition that the subject of the attitude verb was uncertain prior to the utterance of the imperative whether the addressee will call Mary. This precondition cannot be satisfied in light of the first sentence. Finally, as it is illustrated in (30), the first sentence in (31c) presupposes that John has an affirmative attitude towards the addressee calling Mary, while the second sentences negates this.

(31)  
a. A: John said call Mary right away! B: #John lied  
b. #John knew you were going to call Mary. He said call her.  
c. #John said call Mary right away. But he didn't think you should.

In summary, the infelicity of discourses in (31) can be shown to follow from the incompatibility of the event-relative semantics of the imperative modal and the accompanying context: by relativizing modals to events, the definedness conditions of imperatives become characterizable as restrictions on events in which the imperative is uttered. If these events cannot fulfill the felicity requirements imposed by the imperative modal, as is the case in (31), the sentence is marked. This accounts for the parallel behavior of matrix and embedded imperatives described in Section 3. The next section describes another prediction of the analysis developed here and touches upon some further issues.

7 Some puzzles

There are two puzzles concerning embedded imperatives that were mentioned only very briefly in the preceding exposition: the limitations on the embedding verb and the nature of the imperative subject. The first puzzle was illustrated in (3), which is repeated below. It concerns the fact that the only attitude verb that allows for embedding of imperatives in English is say.

(3)  
a. *John claimed (that) [call Mary]  
b. *John knows (that) [call Mary]

The approach to imperatives and modality espoused above allows for a natural explanation of some restrictions on what the embedding verb may be: it has to be a verb of saying that describes events in which, roughly, a command has been expressed. Namely, as it is defined in (28), the accessibility relation of imperatives and other performative deontic modals selects only for events in which certain properties hold of the agent, e.g. the speaker in the speech event. The sentences in (3) have the structures given in (32) where the event arguments of the imperative modal are co-indexed with
the event arguments of the attitude verbs *claim* and *know*, respectively. On the one hand, although a minimal knowing event(uality) e does contain a cognizing individual – a holder of certain beliefs and knowledge – that individual is not an agent of the event and, accordingly, \( R_{imp}(e) \) is undefined (presuppositions of the imperative modal require there to be an agent in the respective speech event). On the other hand, the agent of a claiming event does not satisfy the authority presupposition triggered by the performative modal. This explains why embedded imperatives can occur only under attitude verbs that can be used to describe events in which a command was uttered.

(32)  

(a)  \[ [\text{Infl } w^*] \lambda e' [John \text{ claim}(e') [\lambda w' \text{ [imp } R \text{ e'} [\lambda w [\text{Infl } w] [\lambda e [\text{you call}(e) \text{ Mary}]])]])]\n
(b)  \[ [\text{Infl } w^*] \lambda e' [John \text{ know}(e') [\lambda w' \text{ [imp } R \text{ e'} [\lambda w [\text{Infl } w] [\lambda e [\text{you call}(e) \text{ Mary}]])]])]\n
However, it is not all verbs of commanding that allow embedded imperatives; for example, *demand* and *order* are unacceptable with an imperative complement (33). Descriptively, all the verbs of commanding that are such that if they take a CP argument, that CP has to have an overt complementizer (34), do not embed imperatives.

(33)  

(a)  *John demanded *(that) call his mom\n
(b)  *John ordered *(that) call his mom\n
(34)  

(a)  John demanded *(that) Mary call his mom\n
(b)  John ordered *(that) Mary call his mom

Accordingly, the fact that the only verb of saying that can embed imperatives is *say* could be explained along the following lines: It is a common assumption that imperatives are CPs where either an imperative feature (Schwager 2006) or some directive feature (Han 1998) is situated in C. This is a position that is also targeted by the complementizer *that*, which cannot have an imperative feature. Therefore, if an attitude verb selects for CPs with an overt complementizer (e.g. *claim*, *order*), an embedding of imperatives is illicit.

The second puzzle concerns the reference of the imperative subject. In matrix imperatives, the subject refers to the addressee in the actual context. This is frequently captured by assuming that the imperative subject *pro* has a second person feature that requires the denotation of *pro* to be the addressee of the utterance. In embedded imperatives, however, the referent of the imperative subject is not necessarily the actual addressee.

(35)  

(a)  John said call his mom, so you should\n
(b)  John said call his mom, and I did\n
c.  John said call his mom, and Bill did\n
d.  John said call his mom, so we will
The sequences in (35) are felicitous. If the denotation of the imperative were just the actual addressee, only (35a) would be expected to be licit: the obligation of the actual addressee to call John’s mom cannot be satisfied by anyone other than the actual addressee. The behavior of the subject of the embedded imperative thus resembles the behavior of arbitrary PRO. The fact that such behavior is not observable with matrix imperatives might be due to pragmatic reasons. A further investigation of this issue is mandated.

In this section, the restricted distribution of embedded imperatives in English was to some extent derived from the semantics of the imperative modal and event-relativity of modality. Furthermore, it was suggested that cases of non-embedding of imperatives under verbs of commanding were due to syntactic restrictions. Finally, it was shown that the denotation of the subject of the embedded imperative does not always straightforwardly correspond to the actual addressee.

8 Conclusion

Although it has often been claimed otherwise, there are embedded imperatives in English. Their semantic properties thereby closely resemble the properties of embedded epistemic modals: their evaluation is to some extent context-sensitive. We have captured this resemblance by adopting Schwager’s (2006) account of imperatives (imperatives denote modal propositions) and Hacquard’s (2006) approach to modality (modals are event-relative).

There are several issues that require further investigation: the restriction of English attitude verbs that allow embedded imperatives to say; the cross-linguistic variation in the embedding of imperatives; the semantics of the embedded imperative subject and its implications for the analysis of imperative subjects in general. First steps in resolving some of these issues were made above, but a lot of theoretical and typological work still lays ahead.

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References


Reference Processes in Intensional Contexts

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Abstract
This paper presents two reading experiments investigating reference processes in intensional contexts. Both studies employ sentence pairs containing a definite NP whose potential antecedent is embedded in an intensional context, where definite anaphora is not supported. Previous work on this topic has shown that the interpretation of such sentences elicit a cost in terms of reading times, because readers undertake inferential or revision processes to derive a coherent text representation. The results of the experiments, however, do not support these accounts. Instead, they are consistent with a new theoretical development based on the notion of non-actuality implicature (Frazier 2008).

1 Introduction

It is well known in natural language semantics that intensional verbs like want, need and look for give rise to contexts in which indefinite noun phrases (NPs) can receive two readings. For example, on one reading of (1a), Mary wants a horse for her birthday, but no particular one, on the other reading, there is a certain horse such that Mary wants it for her birthday:

(1) a. Mary wants a horse for her birthday.
    b. John is looking for a unicorn.

The two readings are usually referred to as unspecific and specific, respectively. On unspecific readings, indefinite NPs do not presuppose the existence of their referent, giving rise to what is often called a lack of existential import. For example, a sentence like (1b) may well be true although unicorns do not exist. As a

1 Another major property of intensional verbs is that substitution of coreferential terms in the complement may not preserve the truth value of the original sentence (for an overview of properties of intensional (transitive) verbs, see Forbes, 2004). In the remainder of the paper, I will refer to verb phrase constructions headed by an intensional verb as intensional contexts.
consequence, complements of intensional verbs generally do not support definite anaphora (Karttunen, 1976; Moltmann, 1997), as seen in (2a) as opposed to (2b) (here ‘#’ means ‘infelicitous on the unspecific reading of the indefinite’):

(2) a. Mary wanted a horse for her birthday. # The horse / it was white and had a golden mane.
   b. Mary got a horse for her birthday. The horse / it was white and had a golden mane.

Although the theoretical investigation on intensionality has a rich tradition, going back at least to Frege (1892) and Quine (1956), the topic has not figured prominently in psycholinguistics. Intensionality has entered this field of research as a ‘tool’ to set up contexts that do not support definite anaphora, as in (2a), in order to investigate whether modal information elicits empirical effects with regard to discourse processing (Dwivedi, Phillips, Lague-Beauvais, & Baum, 2005) and the nature of the inferential processes that readers undertake to achieve coherent text representations (Haviland & Clark, 1974). The empirical evidence collected in these studies suggests that intensionality affects discourse processing. However, the nature of the mechanisms that underlie the online processing of sentence pairs such as (2a) is still an open question.

In the present paper I present two experimental studies focusing on the interpretation of definite NPs in intensional contexts. I argue that the results of these experiments do not support previous accounts of intensionality effects in discourse processing. Instead, they are predicted by a new theoretical development (Frazier, 2008) based on the notions of accommodation and non-actuality implicature. The paper is organized as follows. In the following section I provide a brief overview and a critical assessment of the relevant psycholinguistic literature. Section 3 presents the two experimental studies that have been carried out. In Section 4, the experimental results are discussed with respect to previous models of discourse comprehension and Frazier’s (2008) notion of non-actuality implicature. Section 5 provides a brief summary and a conclusion.

2 Background

As mentioned above, intensionality is not a core topic in psycholinguistics. However, intensional verbs have been exploited to test theories of reference processes during discourse comprehension. Specifically, sentence pairs such as (2a) as opposed as (2b) have been used to investigate anaphoric bridging processes (Haviland & Clark, 1974, Experiment 2) and theories of modal subordination (Dwivedi et al., 2005). These studies were motivated by the basic assumption in discourse processes research that, while processing a text, the reader’s goal is to build a coherent representation in which incoming information is related to earlier portions of text via anaphoric or inferential processes (e.g. van Dijk & Kintsch, 1983; Kintsch & van Dijk, 1978; Gerrig & McKoon, 1998; Sanford & Garrod, 1981; Wolf, Magliano, & Larsen, 2005).
consequence of this assumption is that if readers are not initially successful in identifying an antecedent for an anaphoric expression, they resort to alternate strategies for establishing coherence.

In the two-sentence discourses illustrated in (2), both the definite NP the horse-which normally presupposes the existence of a referent (Russell, 1905; Strawson, 1950) and signals that it is already given or familiar to the interlocutor (Heim, 1982)-and the pronoun it require an antecedent to be interpreted. While in (2b) the antecedent is already given in the context sentence, in (2a) it must be accommodated as a new discourse entity, provided that the indefinite in the context sentence is interpreted as unspecific. As a consequence, readers must undertake additional processing in order to build a coherent text representation. In support of this prediction, the experimental studies reported in Haviland & Clark (1974) and Dwivedi et al. (2005) consistently showed a processing cost associated with sentences containing definites whose potential antecedents are embedded in an intensional rather than an extensional context. The two studies, however, offer two different accounts of their findings and, more important, both are problematic from the methodological point of view.

To begin, Haviland & Clark (1974; Experiment 2) used intensional contexts to control word repetition effects in the investigation of inferential bridging processes. Specifically, in their first experiment, they showed that a sentence like The beer was warm is more difficult to process when it follows a context sentence like We checked the picnic supplies than We got some beer out of the trunk because readers need time to make a bridging inference which relates beer to picnic supplies, in order to generate a coherent text representation. Although the reading time difference could be indicative of bridging processes, there was an obvious alternative explanation of their finding: the repetition of the word beer in the easier condition might have facilitated the processing of the target sentence, causing faster reading times than in the harder, bridging condition. To control word repetition effects, Haviland & Clark (Experiment 2) tested sentence pairs like those in (3), where a repetition of the critical word was obtained in both conditions but, crucially, definite anaphora was supported only in (3a, b):

(3) a. Ed was given an alligator for his birthday.

a’. Ed wanted an alligator for his birthday.

b. The alligator was his favourite present.

Haviland & Clark hypothesized that in order to establish a coherent representation of the sentence pair (3a’, b), the comprehender needs to infer that Ed actually got an alligator for his birthday, and that alligator was his favourite present (Haviland & Clark, 1974, p. 516). The bridging process, here, consists in accommodating a new discourse referent for the definite NP and interpreting it as standing for the alligator that Ed got for his birthday. The results of the experiment supported this hypothesis showing longer reading time for (3b) following (3a’) than (3a). This finding, however, does not necessarily prove that intensional contexts affect discourse processing. The experimental paradigm used in the study does not enable us to assess whether the costly process is the accommodation of a new discourse referent
due to the anaphorically inaccessible context, as claimed by Haviland & Clark, or an otherwise motivated bridging inference. Consider the sentence pair given in (4):

(4) The day of his birthday, Ed saw an alligator at the pet shop.
The alligator was his favourite present.

Here, nothing prevents the definite NP to be interpreted as coreferentially linked to the indefinite in the context sentence. However, a bridging inference is required to coherently connect the event of seeing an alligator and the information that that alligator was Ed’s favourite present (at least, it is necessary to infer that someone gave Ed the alligator as a birthday present!).

More important, Haviland & Clark instructed participants in the experiment to “[…] be sure to read and pay attention to the first sentence in each pair since it would be related to the second. But, [they were] told, it was the second sentence that [they] were interested in […])” (p. 515). These instructions might have induced participants to actively find a detailed bridge between the two sentences in each pair, producing reading time differences as a function of task demands rather than the experimental manipulation.

Finally, Haviland & Clark did not take into consideration that, upon encountering the definite NP in the target sentence, participants might have been biased to adopt a specific interpretation of the indefinite in the context sentence. When computed, a specific reading of the indefinite supports definite anaphora and makes the discourse coherent. The latter hypothesis has been investigated in an Event Related Potential (ERP) study by Dwivedi et al. (2005).

The experiment tested materials like (5):

(5) a. John is writing a novel. It ends quite abruptly
b. John is considering writing a novel. #It ends quite abruptly.

In (5a), the indefinite a novel can act as antecedent for the pronoun in the target sentence. In (5b), by contrast, the intensional verb consider produces an intensional context where anaphora resolution is blocked. The results of the experiment showed a P600-like effect, with a frontal distribution, elicited by the verb in the second sentence (ends) of (5b) compared to (5a), suggesting a revision in discourse structure. The revision process was explained within the theory of modal subordination outlined in Roberts (1987, 1989, 1996). Robert’s theory builds on Kamp’s (1981) Discourse Representation Theory in which information that is conveyed in discourse is structurally represented in a Discourse Representation Structure (see also Kamp & Ryle, 1993). In Robert’s theory, elements that are under the scope of modal or intensional operators are represented in subordinate structures and are not accessible for anaphoric reference from entities appearing in the main structure, where factual information is represented. The P600-like effect was thus interpreted as a structural revision of the context sentence in which the processor computes a specific interpretation of the indefinite NP in order to authorize anaphora resolution. Such specific interpretation comes about by accommodating the discourse referent
associated to the indefinite into the main discourse structure, where it becomes accessible to the pronoun. The interpretation of (5b) as achieved through this structural revision process would be paraphrasable as *John is considering writing a certain novel that he has in mind and it ends quite abruptly.*

Although Dwivedi et al.’s study used pronouns instead of full definite NPs, their results suggest that in Haviland & Clark’s Experiment 2 participants might have spent additional time in revising the context sentence in order to provide the definite NP with a structurally accessible antecedent. However, a word of caution is in order. The results reported in Dwivedi et al. may be questionable at the methodological level. The analysis at the verb position, in fact, used as baseline correction a time window where the authors had shown a negative ERP effect starting at about 500 ms after the onset of the pronoun in the intensional condition. This may have produced a seeming long lasting positivity after the verb at similar scalp locations.

To summarize, the experimental investigation on reference processes in intensional contexts has produced controversial results. Several questions are still open and need further investigation. For example, even supposing that reference processes in intensional contexts elicit a cost in terms of reading times, it would be useful to investigate the locus and time-course of such cost. A clear prediction in this respect can be made if we consider that anaphora support is possible when the anaphor occurs in the context of modal subordination (Roberts, 1996; Moltmann, 1997), as in (6):

(6) Mary wants a horse for her birthday. It *must* be white and have a golden mane.

The consequence for a theory of processing is that, upon encountering the pronoun, the processor has still the possibility to build a coherent representation of a sentence like (6). It is at the verb position of the second sentence that the felicity of the discourse can be judged and, if need be, a repair strategy undertaken. Thus, we might expect a cost to be localized around the verb region of the second sentence of (3a’, b). This prediction has been tested in the following studies.

## 3 Two experimental studies on intensionality in discourse processing

The two experimental studies reported in this section build on previous research to investigate how intensional contexts affect discourse processing. Before presenting the experimental investigation, a few remarks are in order with respect to the experimental methodologies that have been used. The first experiment employed the self-paced reading method, which is one of the most commonly adopted method to investigate sentence and discourse comprehension. In this method, items can be presented

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2 In ERP experiments, it is crucial to ensure that an effect is not already present in the signal before the target stimulus was actually presented. If this was the case, it would indicate that the signal is contaminated by a confound that is not stimulus-related.
sentence-by-sentence, phrase-by-phrase, or word-by-word. Experiment 1 used a non-cumulative phrase-by-phrase presentation, which is also called moving window technique. In this technique, segments appear first in the form of a set of dashes, with each dash corresponding to a character and with spaces between dashes corresponding to spaces between words. With each press of a key, a segment is revealed on the screen and, with each subsequent press, the subsequent segment appears and the previous one disappears. Thus, participants are able to control the rate of presentations of the materials, and reading times are recorded between each press of the key. The moving window technique is informative about possible processing difficulties associated with a fragment: the greater the processing difficulty and the longer the reading times. Experiment 1 used this technique to assess whether the cost previously found by Haviland & Clark (1974)- a cost detected by the time taken to read the whole target sentence- could be replicated and, if so, at which phrase of the sentence it would be revealed.

Experiment 2 used the eye-tracking methodology, which allows participants to read in a more naturalistic way and to look back at earlier portions of the text. By monitoring eye-movements during reading, this technique measures fixation times on critical words or regions of a text as well as regressive movements towards previous regions. A lot of factors, both lexical (e.g., length and frequency of a word) and contextual (e.g., predictability and ease of integration of a word into a sentence or discourse) have been found to influence fixation times during reading (Just & Carpenter, 1980; McConkie, Hogaboam, Wolverton, Zola, & Lucas, 1979; Rayner, Sereno, Morris, Schmauder, & Clifton, 1989; see Rayner, 1998 for an overview). Interestingly, there is abundant evidence that fixation time in the region of an anaphoric expression varies as a function of how it is easy to make the link between the anaphor and its antecedent (e.g., Ehrlich & Rayner, 1983; Albrecht & Clifton, 1998; Garrod, Freudenthal, & Boyle, 1994; Kennison & Gordon, 1998; Paterson, Sanford, Moxey, & Dawydiak, 1998).

To determine the existence, locus, and time-course of processing difficulties, it is first necessary to define the region of interest and then analysing the temporal processing associated with that region. There are several measures that can be used as an index of processing time. In Experiment 2, the following measures have been considered: first-pass time, which is defined as the sum of all fixations beginning with the reader’s first fixation in a region until the reader’s gaze leaves the region; total time, which is the sum of all the fixations made in a region, including the time spent in the region after regressing back to it; second-pass time, which is the time spent in a region after leaving it either to the left or to the right. Notice that reference processes are assumed to be captured by early processing measures, like first-pass times, while higher-level integration processes, like bridging inferences, are more likely to be detected by measures of later processes, like second-pass or total reading time (Sturt, 2003).
3.1 Experiment 1

3.1.1 Method and materials

Experiment 1 was designed to replicate the effect obtained by Haviland & Clark (1974; Experiment 2) using different materials in a different language (Italian)\(^3\). The experiment tested sentence pairs such as those illustrated in (7):\(^4\):

**Context**

(7) a. Il cuoco comprò/ una pentola nuova/ per il suo ristorante.  
   The chef bought/ a pot new/ for the his restaurant.  
   'The chef bought a new pot for his restaurant.'

a’. Il cuoco voleva/ una pentola nuova/ per il suo ristorante.  
   The chef wanted/ a pot new/ for the his restaurant.  
   'The chef wanted a new pot for his restaurant.'

**Target**

b. La pentola/ costò/ parecchio.  
   The pot/ cost/ (PAST) a lot.

The first sentence of each item began with a definite NP or a proper name followed either by an extensional construction \([\text{bought a saucepan} \text{ in (7a)]}\) or an intensional one \([\text{wanted a saucepan} \text{ in (7a’)]}\). The target sentence (7b) always began with a definite NP lexically identical to the indefinite in the context sentence, followed by a verb in the indicative past tense. Given the similarities between the present manipulation and the one employed by Haviland & Clark, it was expected to find longer reading times for the target sentence following (7a’) than (7a). However, the main interest was in the locus of the expected effect. Based on Roberts (1996) and Moltmann (1997), the prediction was to observe an effect localized at the verb position, where it becomes clear that the referent for the definite NP must be accommodated as a new discourse entity.

A set of 40 target sentences was created in the form illustrated in (7b) above. Two context-sentences for each target sentence were created, one containing an extensional construction and the other an intensional one. The intensional constructions were built using a total of 13 intensional (transitive) verbs, including, among others, cercare (look for), desiderare (wish), temere (fear for). The 80 sentence pairs were divided up into two lists of 40 pairs. Each list contained 20 extensional sentence pairs and 20 intensional ones, with the constraint that if an extensional pair occurred on one list, its matched intensional pair occurred on the other. Half the

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\(^3\) Cross-linguistic differences between English and Italian are assumed to be not relevant for the purposes of the experiment.

\(^4\) The character ‘/’ indicates the section break between the chunks of the sentences that were displayed at one time in the moving-window display.
subjects received one list, and half the other. Stimuli presentation and recording of
latencies were controlled by E-Prime Software. Sentences were divided up into three
chunks and presented using the moving-window technique. On the first screen, all
characters of the first sentence were replaced by dashes. Participants had to press the
space bar to see the first chunk of the sentence. When they pressed the space bar again,
the first chunk was replaced by dashes, and the second chunk was displayed. Another
press of the space bar caused the context sentence to disappear and the dashes
replacing the characters of the target sentence to appear. At this point the procedure
was the same as before.

Experimental items were displayed along with 139 filler sentences of various
type and length. Comprehension questions, to which participants had to answer
pressing one of two buttons, followed 50% of the trials. 16 native speakers of Italian
took part in the experiment.

3.1.2 Results and discussion

The mean reading times for each segment of the target sentences are shown in Table 1.
Data from each segment were subjected to analysis of variance (ANOVA), treating
participants (F1) and items (F2) as random variables. Reading times that were 3
standard deviations above or below the mean in each phrase position were excluded by
the analysis. This resulted in less than 3% of the trials discarded.

<table>
<thead>
<tr>
<th>Table 1. Mean reading times [ms] for conditions by segment:</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
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<td>3</td>
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<tr>
<td></td>
<td>La pentola</td>
<td>costò</td>
<td>parecchio</td>
</tr>
<tr>
<td></td>
<td>(The pot)</td>
<td>(cost)</td>
<td>(a lot)</td>
</tr>
<tr>
<td>Extensional context</td>
<td>600</td>
<td>572</td>
<td>620</td>
</tr>
<tr>
<td>Intensional contexts</td>
<td>594</td>
<td>565</td>
<td>609</td>
</tr>
</tbody>
</table>

The analysis revealed no significant differences at any phrase of the target
sentence [all Fs<1]. Therefore, the bridging effect reported in Haviland & Clark (1974)
was not replicated in the present experiment. Quite surprisingly, readers seemed to find
target sentences following an intensional context as easy to process as following an
extensional one. It is, however, possible, that the bridging effect was somehow masked
by the way in which materials were presented. In the present experiment, whenever a
new chunk appeared, the previous one disappeared. Consequently, readers were not
able to reread portions of the target sentence whenever they needed to. Haviland &
Clark’s experiment, by contrast, used a whole sentence presentation, so that
participants were able to re-access previous portions of the target sentence without
restraints. The bridging effect might have emerged during such re-reading stages. In
view of this possibility, the following experiment employed the eye-tracking methodology which gives an extremely fine-grained and continuous picture of the time-course of processing, while allowing participants to read in a more naturalistic way and to look back at earlier portions of the text.

3.2 Experiment 2

3.2.1 Method and materials

The aim of Experiment 2 was twofold: first, to assess whether the failure to replicate Haviland & Clark’s effect in Experiment 1 was due to the way in which materials were presented; secondly, to test Dwivedi et al. (2005) hypothesis that the interpretation of anaphoric expressions whose potential antecedents are indefinite NPs in intensional contexts requires a revision in discourse structure to compute a specific reading of the indefinite. The basic strategy to test these hypotheses was to present participants with sentence pairs in four conditions, like those illustrated in (8):

(8)  

a. John devoured a pastry for dessert at the dinner with his friends.  
The pastry was his favourite course.

b. John wished a pastry for dessert at the dinner with his friends.  
The pastry was his favourite course.

c. John devoured a pastry that his mother had prepared for him.  
The pastry was his favourite course.

d. John wished a pastry that his mother had prepared for him.  
The pastry was his favourite course.

As in Experiment 1, the first sentence of each item began with a proper name or a definite NP followed by either an extensional construction (devoured a pastry) or an intensional transitive one (wished a pastry). The final clause of the sentence, however, was manipulated in order to obtain a condition in which the indefinite NP in the intensional construction could be interpreted as specific. The specific reading was obtained using, for example, a ‘that’-clause. In (8d), if John wished a pastry that his mother had prepared for him, it means that he wished a specific pastry. Thus, in this condition, the discourse referent associated with the indefinite can act as antecedent for the definite in the target sentence and revision strategies such as those hypothesized by Dwivedi et al. (2005) are unnecessary.

To summarize, the experimental manipulation combined two factors: the type of verb (extensional versus intensional) and the type of object (unspecific versus specific), which resulted in a 2x2 design. The verb-type manipulation allowed us to investigate whether the bridging effect found in Haviland & Clark (1974) could be replicated using the eye-tracking methodology. On this hypothesis, it was expected a
main effect of verb type with longer (re)reading times on the target sentence following an intensional context than an extensional one. The object-type manipulation allowed us to investigate the hypothesis advanced in Dwivedi et al. (2005) according to which the interpretation of the target sentence in (8b) requires a computation of a specific reading of the indefinite, which is unnecessary in (8d). On this hypothesis, it was expected an interaction between the two experimental factors, with longer reading times for the target sentence in condition (8b) compared to all the others.

The study included 32 sentence pairs in each of the four conditions. The sentence pairs were counterbalanced across conditions in four lists. Participants saw each sentence pair in one condition. A Generation 5.5 Fourward Technologies Dual Purkinje Image eye-tracker monitored participants’ eye movements. At the beginning of the experiment, participants were seated at the eye-tracker, and a bite-bar and a forehead rests were used to minimize head movements. The tracker was then aligned and calibrated using a series of nine fixation boxes that participants were asked to fixate as they appeared on the computer screen. Before each trial, a pattern of boxes appeared on the computer screen. Participants were instructed to fixate the upper left box, at which point the target text appeared, with the first characters of the text replacing the fixating box. Experimental items were presented as two written lines, with two blank lines between each line of text. The experiment included 158 filler items of various type and length. Comprehension questions, to which participants had to answer pressing one of two buttons, followed 50% of the trials. 32 native speakers of English took part in the experiment.

3.2.2 Results and discussion

For the purpose of the analysis the target sentences were divided up into two regions, the first one containing the definite NP (*The pastry*), and the second one containing the other words of the sentence. First-pass, second-pass and total reading time data for the two regions of analysis were subjected to a 2X2 ANOVA that treated both factors as within-participants (*F*1) and within-items (*F*2).

The analysis of total time data did not show any main effects or interactions. The analysis of first-pass data at the region containing the definite NP revealed an interaction between the two experimental factors that was significant only in the analysis by participants (*F*1(1, 31) = 4.486, *p*<.05; *F*2 <1). Simple effects analysis revealed that for sentences containing unspecific objects, first-pass reading times were longer when the verb was *extensional* rather than intensional, while for sentences containing specific objects there were no differences. The lack of significance in the analysis by materials, however, prevents us from generalizing this result over items (Clark, 1973). The analysis of second-pass times in the final region of the target sentence produced a main effect of object-type, which was significant by participants, and marginally significant by items (*F*1(1, 31) = 5.532, *p* < .05; *F*2(1, 31) = 2.918, *p* < .1), with longer re-reading times when the first sentence contained a specific object than an unspecific one. No other main effects or interactions were revealed in the second-pass measure.
To summarize, the experimental manipulation did not produce any main effect or interactions that could be interpreted as supporting bridging or antecedent reanalysis hypothesis. First-pass data at the definite NP, although not significant in the analysis by items, could be interpreted as an example of the ‘repeated name penalty’, according to which the use of a repeated NP to refer to an highly accessible referent results in more demanding integration processes (Almor 1999). The main effect of object type in second-pass reading times at the post anaphoric region appears to be unrelated to bridging or reanalysis processes as well. Thus, the question arises as to whether reference processes are affected by intensional contexts and, if so, how. The following section discusses the results with respect to a new theoretical development outlined in Frazier (2008). It will be argued that Frazier’s account provides new insight into how intensional contexts affect reference processes in discourse comprehension and, more important, predicts the kind of results here reported.

4 The role of intensionality during discourse processing

The results from both Experiment 1 and Experiment 2 do not support previous accounts of reference processes in intensional contexts. The processing cost associated with sentences containing defines whose potential antecedents are indefinite NPs embedded in intensional contexts- a cost reported by both Haviland & Clark (1974) and Dwivedi et al. (2005)- has not been replicated in the present experiments. This null result, however, does not imply that intensional contexts do not affect reference processes during discourse comprehension. The previous experimental investigation on this topic, in my view, suffers from a key problem: too little attention has been paid to the processing of intensional contexts.

It has been argued, both in theoretical and empirical research, that sentences containing modal and intensional operators carry a negative presupposition (Roberts, 1996) or, in Frazier’s (2008) terminology, a ‘non-actuality implicature’. A sentence like *A trip should be planned for August*, for example, implies that a trip has not already been planned. Similarly, a sentence like *John is looking for a horse* implies that John has not already found one. Following Frazier’s account, in this latter example, the non-actuality implicature can be represented as in (9), where Wo stands for the actual world:

(9)   \[ \text{Wo: NOT (John finds a horse)} \]

In this example, the implied contrast between the actual world and the asserted content may implicitly focus the content of a certain goal state that, if it was achieved, would be represented as the proposition that *[John finds a horse]*. Thus, non-actuality implicatures make salient a certain goal state that, crucially, may influence processing of subsequent elided constituents. In other words, “non actuality implicatures serve as a focusing device, guiding the processor to, seemingly effortlessly, build just the structure/interpretation required for elided constituents with flawed antecedents” (Frazier, 2008; p. 26, the italic is mine).
To illustrate the relevance of this prediction for our topic of research, suppose that the interpretation of a sentence pair such as (10a) requires the accommodation of an implicit restrictor for the definite NP, as illustrated in (10b):

(10) a. Mary wanted a horse for her birthday. The horse was her favourite present.
    b. Mary wanted a horse for her birthday. The horse *that she got* was her favourite present.

The content of the implicit restrictor can be easily reconstructed from the non-actuality implicature carried by the context sentence (i.e., *Mary does not have an horse in the actual world*). Such implicature makes salient the goal state achieved when Mary gets a horse for her birthday. The content of this goal state can act as antecedent for the implicit restrictor that should be reconstruct to interpret the definite NP in the continuation sentence. The consequence for a theory of processing is that the non-actuality implicature hypothesis predicts that sentences such as those investigated in the experiments reported here are likely to be processed at no cost. In other words, the non-actuality implicature hypothesis predicts the kind of results we have found.

It remains to be explained the discrepancy between our results and those reported in the literature, particularly in Haviland & Clark (1974). One possible explanation lies in the materials used the experiments. Haviland & Clark reported only two examples of their experimental materials which, crucially, differ in the presence of a non-actuality implicature. In the first one, (a) *Ed wanted an alligator for his birthday. The alligator was his favourite present*, the context sentence implies that Ed did not have an alligator, thereby providing a salient antecedent for the definite NP. In the second one, (b) *Andrew was especially fond of beer. The beer was warm*, the context sentence does not carry a non-actuality implicature and, consequently, there is no salient goal state that can guide the reader to build an interpretation for the second sentence. As a result, the second sentence of (b) should elicit a cost, either because the reader needs to build from scratch a bridge between the two sentences, or because the bridge is even impossible to build. Since Haviland & Clark’s list of materials is no longer available, we are not able to ascertain how many items were like (a) and how many like (b).

To conclude, although Frazier’s account requires further investigation, what it seems to suggest is that, contrary to what has been argued in the literature, intensional contexts affect reference processes by facilitating, under certain circumstances, the recover of a coherent text representation. As a consequence, the experimental investigation of reference processes in intensional contexts cannot disregard how intensional contexts are actually processed and understood. Further investigation should take into careful consideration the semantic and pragmatic properties of intensional contexts and their influence on online sentence and discourse processing.
5 Conclusion

I have argued that the results from the studies reported here do not support previous accounts of reference processes in intensional contexts according to which comprehenders undertake costly inferential or revision processes to recover coherent text representations. The results, however, are consistent with a recent view developed by Frazier (2008), according to which non-actuality implicatures triggered by intensional contexts can guide comprehenders to effortlessly reconstruct coherent text representations. The crucial implication for future research on this topic is that the investigation of how intensionality affects discourse processing cannot disregard a detailed study of the online processing of intensional constructions.

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References


Metalinguistic Comparatives in Greek and Korean: Attitude Semantics and Expressive Content

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Abstract

In this paper, we present a parallel between Greek and Korean in metalinguistic comparatives (MCs), and propose an analysis for both languages that combines an attitudinal semantics (building on Giannakidou and Stavrou 2008) with expressive meaning. The comparative morpheme supplies the former, and the than-particle supplies the latter. We discuss also data from Korean showing a two way distinction between “regular” MCs, and antiveridical MCs. We argue that the use of MC than particles, in all variants, brings about an individual’s emotive state, and propose that the morphemes contain expressive indices in the sense of Potts 2007. Our analysis has two implications: first, it allows the hypothesis that all metalinguistic functions in language are indeed part of the grammar in the particular way formulated here; second, our use of expressive indices supports Potts’s view of the expressive component as separate, but interacting, with the descriptive content: the than particle is not vacuous, but the place where descriptive and expressive meaning interact.

1 Introduction: metalinguistic comparative in English and Greek

Metalinguistic comparatives (MCs) are a topic that remained largely unexplored in the literature on comparatives. With the exception of very brief discussions (McCawley 1968, Bresnan 1973, Embick 2007), until recently very few works addressed the question of how MCs differ, if at all, from ‘regular’ comparisons of degrees. MCs were easy to think of as just non-canonical uses of regular comparatives, just like with metalinguistic negation (Horn 1989).

In a recent paper, Giannakidou and Stavrou (GS) argue that MCs in Greek are indeed grammatical creatures, with a syntax and semantics distinct from that of regular comparatives. In Greek, MCs are realized with the preposition para ‘than’, which is lexically distinct, as we see, from the regular clausal comparative apoti:
(1) Ta provlimata su in perissotero ikiomika para nomika.
the problems yours are more financial than legal
‘Your problems are financial more than legal.’
‘Your problems are financial rather than legal.’

(2) O Pavlos ine perissotero filologhos {para/apoti} glossologhos.
the Paul is-3s more philologist than linguist
‘Paul is more of a philologist than he is a linguist.’
“Paul is a philologist rather than a linguist.”

Para comparatives have the meaning of metalinguistic comparison, reinforced in English with the order reversal between financial and more, which is only allowed in MC, and the use of rather. The sentence in (1) is intended to convey that the speaker believes it is more appropriate to say that the addressee’s problems are financial, than that they are legal; likewise, (2) conveys that the speaker believes that the proposition “Paul is philologist” is more appropriate than the proposition “John is a linguist”.

Using para is optional mostly, but when para is used, the sentence is not simply a variant of the apoti comparative. Sentences with para are more emphatic, expressing disapproval or dispreference towards the than part. The use of rather in English, likewise, conveys some kind of emphatic dispreference too, and implies that the speaker believes John to be not a good linguist.

In this paper, we maintain that the lexicalization of MC observed in Greek is not an accident—Korean too, we show, exhibits a MC than like para: kipota. Strikingly, Korean lexicalizes additionally a “negative” comparative morpheme, charari, the analysis of which, we will argue, carries over to rather. The discussion proceeds as follows. First, in section 2 we present the properties of para and kipota comparatives which render them distinct from regular comparisons. In section 3, we give an attitudinal semantics for MCs, and in section 4, we further identify charari as an antiveridical (i.e. negative) version of MC. In section 5, we augment the attitudinal semantics with expressive indices (Potts 2007) that range over a negative interval. This is the contribution of the than-particles. We conclude with brief comments on NPI licensing—which we discuss more thoroughly in Giannakidou and Yoon 2008).

2 Metalinguistic Comparatives in Greek and Korean

In this section we summarize the properties of MCs following GS. In particular, the than-clause in the MC is clausal, and that it has undergone ellipsis (in the sense of Merchant 2006). In the literature on Greek comparatives (Stavrou 1982, Merchant 2006), two types are distinguished: a clausal one, introduced by apoti “than.wh” (with a variant aposo for amounts), and a phrasal one, introduced with apo. The para clause is a variant of the apoti syntactically.

Regarding the comparison forms used, in Greek, two types are distinguished: (a) a synthetic form, based on the bound morpheme -(o)ter- attached to the adjectival
stem and followed by the inflectional affix, and (b) two **analytic** forms consisting of the free morphemes *pjo* or *perissotero* ‘more’ followed by the adjective:

(3) I Kiki ine psiloteri apoti i Ariadhni.  
the Kiki is taller than the.nom Ariadne

(4) I Kiki ine {pjo/perissotero} psili apoti i Ariadhni.  
the Kiki is more tall than the.nom Ariadne

‘Kiki is more tall than Ariadne.’

(5) I Kiki pezi kithara kalitera apoti i Ariadhni.  
the Kiki plays guitar better than the.nom Ariadne

‘Kiki plays the guitar better than Ariadne.’

With *para*, the degree adverbial is usually the synthetic of the adverb *poli* ‘much’—*perissotero*—, but it can also be *pjo* ‘more’, the base adverb *poli*, and quite often *kalitera* ‘better’. Kalitera comparatives sound a bit more emphatic and “negative”, as we see later. The *para* remnant can belong to various syntactic categories:

(6) Perissotero xazevi para dhjavazi. (TP)  
more is goofing off than studying

‘He is goofing off rather than studying.’  
:['It is more accurate to say that “he is goofing off” than to say that “he is studying”.’]

(7) Kalitera na se dino para na se taizo!  
better to you dress than to you feed

‘I would rather clothe you than feed you.’  
[= It costs me more to feed you than to clothe you—i.e., you eat a lot!]

Korean employs *pota* for both clausal and phrasal comparative (for diagnostoc of the prepositional use of *pota* see Giannakidou and Yoon 2008). In the clausal comparative *pota* is a complementizer, preceded by a free-relative clause marker *kes*.

(8) Kim-un [Lee-ka khun-kes]-pota (te) khu-ta. (clausal)  
he-Top [Lee-Nom tall-FRel]-than more tall-Decl

‘Kim is taller than Lee is tall.’

The comparative predicates (*taller*) are formed in free variation with or without the comparative modifier *te (more)* in Korean regular comparative, just like the Greek analytic form (the synthetic form is unavailable in Korean). Hence, we assume that the *pota* clause contains an operator yielding an ordering relation between two degrees of properties, following the standard semantic analysis (von Stechow 1984; Kennedy 1997; Heim 2000 among others).

In parallel to Greek, MCs are also lexically marked in Korean: by *kipota*:
(9) Kim-un enehakca-la-kipota chelhakca-i-ta. (N)
    Kim-Top linguist-Decl-saying.than philosopher-be-Decl
    ‘Kim is more of a philosopher than he is a linguist.’

(10) Ku-nun kongpwuhan-ta-kipota nolkoiss-ta. (TP)
    he-Top studying-Decl-saying.than goofing off-Decl
    ‘It is more accurate to say that “he is goofing off” than to say that “he is studying”.’

Importantly, clause types in Korean are distinguished by the use of sentence-ending illocutionary force markers such as interrogative *ni*, exclamative *ela*, and declarative marker *la* or *ta*. Since the role of these markers is to indicate the communicative purpose of a sentence, they only attach to a “propositional” content rather than a predicate. For instance, even when the declarative *ta* is attached to an apparent noun form as in Sue-ta (Sue-Decl), it is interpreted as ‘It is Sue’ rather than ‘Sue’. (This is unsurprising considering that Korean is a pro-drop language and the expletive subject ‘it’ is only optional.) Our *kipota* comparatives, as we see, are accompanied by *la* or *ta*, which mark them formally as clausal.

With this basic background, we can now proceed to show how *para* and *kipota* comparatives differ from regular comparatives in Greek and Korean.

2.1 *Para and Kipota* do not express “regular” comparison

Consider the simplest case of predicative comparative:

(11) *I Kiki ine pjo psili para i Ariadhni.
    the Kiki is more tall than the Ariadne
    [Intended: ‘Kiki is taller than Ariadne.’]

(12) Kim-un Lee-*{kipota/pota} khu-ta.
    Kim-Top Lee-saying.than than tall-Decl
    (Intended: Kim is taller than Lee.)

These sentences cannot be used to convey that the degree to which Kiki/Kim is tall is greater than the degree to which Ariadne/Lee is tall. The impossibility of *para* and *kipota* as predicative comparatives suggests that there is no degree abstraction of the regular kind in the *para*-clause.

2.2 Incompatibility with the synthetic comparative

*Para* is not compatible with the synthetic form of the comparative adjective or adverb:

(13) *O Pavlos ine eksipnoteros para erghatikos.
    ‘#Paul is smarter than he is industrious.’
The same effect has been observed for MCs in English (McCawley 1988, Embick 2007 and references). Again, this suggests a deviation of the *para*-clause from the regular comparative in terms of routine degree abstraction. In Korean, as we noted earlier, synthetic comparatives are unavailable, but the difference arises in terms of the availability of *te* (“more”). While *te* is totally optional in regular *pota* comparatives, *kipota* is incompatible with it:

(14) * Lee-nun pwucirenha-ta-*kipota* te ttokttokha-ta.
    Lee-Top industrious-Decl-saying than more smart-Decl
    ‘Lee is clever more/rather than industrious.’

### 2.3 No *para* or *kipota* in comparison of deviation

*Para* is not possible in a comparative of deviation:

(15)  I Mesoghios ine pjo vathia {apoti/*para*} i Adhriatiki ine rixi.
    the Mediterranean Sea is more deep than the Adriatic is shallow.
    ‘The Mediterranean Sea is deeper than the Adriatic is shallow.’

The impassibility of *para* here is another manifestation of the general inability of this type of comparative to express regular degree comparison. These structures also tell us that the *para* remnant must contain one term only, not more, as is the case here where two pairs are compared: the Adriatic and Mediterranean, and the predicates *deep* and *shallow*. Korean *kipota* follows the Greek pattern:

(16) * Cicwunghay-nun aduriahay-ka nac-*kipota* kip-ta.
    Mediterranean-Top Adriatic-Nom shallow-saying than deep-Decl
    ‘The Mediterranean Sea is deep more than the Adriatic is shallow.’

### 2.4 Comparative float

The comparative morpheme *perissotero* can “float”: it can precede or follow the contrasted constituent, and can also appear sentence-initially. In regular comparatives it can only immediately precede the adjective, as we see:

(17) a.  *Ine (perissotero) eksipnos (perissotero) para erghatikos.*
     is (more) clever (more) than industrious

b.  *Perissotero ine eksipnos para erghatikos.*
    More is clever than industrious
    He is clever more than he is industrious.
Apoti is thus less flexible vis-à-vis adverb position, as we see. By contrast, the MORE adverbial can be positioned in various places when we have para. This flexibility of MORE with para encourages us to think of it as as a (sentential) adverb. We cannot apply this test to Korean because because te is incompatible with kipota.

### 2.5 Single remnant constraint

GS note that para comparatives contain only a single constituent. (This test cannot be applied to Korean.) Contrast the sentences below with apoti and para:

(19) a. Gnorizo perissotoyro tin Elena apoti gnorizo tin adherfi tis.
    know-1sg more the Elena than know-1sg the sister hers
    ‘I know Elena more than her sister.’

    b. *Gnorizo perissotoyro tin Elena para gnorizo tin adherfi tis.

The verb in the para version must be omitted, but it need not in the apoti version; hence the ellipsis with para appears to be stricter than with apoti. A useful way of looking at this is to assume that it has to do with the expressive nature of para. It is helpful to note an observation by Potts and Roeper 2006 that some expressives—n expressive small clauses—are predicate bare, and disallow systematically the use of verbal functional elements:

(20) a. You fool!

    b. *You a fool.

    c. *You are fool.

    d. You are a fool.

(The example in d is just a regular proposition.) According to Potts and Roeper, impoverished structure is part-and-parcel of the fact that expressives are generally very bad at combining directly with the material around them. As a result, they are either very minimal (like a, and the MC para clauses), or they are indifferent to what is around them (as in 'abso-fucking-lutely'). If our analysis (to be fleshed out soon) that para contains expressive content is correct, then the predicate dropping can be understood as a typical behavior of the natural class para belongs to.

To conclude, we saw in this section Greek and Korean employ MC than markers that are lexically distinct from the thans used in regular clausal degree.
comparisons. This is an impressive fact, first, because Greek and Korean are genetically not related, and second, because if metalinguistic functions are just pragmatic, we don’t expect systematic lexicalizations. We now turn to the semantics.

3 An attitude semantics for metalinguistic MORE

By choosing to use a comparative with para, the speaker expresses a disbelief or disapproval towards the para-proposition, and she believes the proposition expressed by the main clause to be more appropriate, desirable, or preferable. GS suggest that the MC must thus have an attitudinal component in it, and locate the attitude in metalinguistic MORE. We will rely here on this analysis, and define a metalinguistic MORE\textsubscript{ML}, distinct from the “regular” MORE of the comparative, which contains a propositional attitude. This attitude is anchored to an individual (the individual anchor employed in the definition below); the anchor is typically the speaker:

\begin{equation}
\text{[[MORE}_{\text{ML}}] = \lambda d \lambda \alpha \exists d[R(\alpha)(p)(d) \land d > \max(\lambda d'[R(\alpha)(q)(d')])] (GS: (40))}
\end{equation}

where \( R \) is a gradable propositional attitude supplied by the context: either an epistemic attitude such as belief, or an attitude expressing preference (desiderative or volitional); \( \alpha \) is the individual anchor (see Farkas 1992; Giannakidou 1998) of the attitude.

Syntactically, MORE\textsubscript{ML} is like a sentential adverb (recall its flexibility in positioning), and in the semantics, MORE\textsubscript{ML} relates two propositions in terms of how much they are \( R \)-ed by the speaker \( \alpha \): the proposition expressed by the main clause \( p \), and \( q \), the proposition of the para clause. MORE\textsubscript{ML} compares the two propositions in terms of the degree to which \( \alpha \) believes them to be appropriate, prefers them, or is willing to assert them.\(^1\) This individual is typically the speaker, as we said, and GS emphasize that the individual anchor is implicit (i.e., it is not syntactically present as an argument). This claim renders the individual anchor of the MC similar Lasersohn’s 2005 judge, i.e. the

\(^1\) A brief final comment is in order here regarding the extension of the attitude semantics we propose to metalinguistic uses that do not prima facie appear to involve propositions, e.g.:

(i) Pio sixna leme “dear” para “darling”.
(ii) More often we say “dear” than “darling”.

Such cases are often discussed in connection to metalinguistic negation (Horn 1989)—and metalinguistic negation is known to negate various aspects of the sentence including pronunciation, words (as in the examples here), and at any rate non-propositional aspects of the sentence. We will take it that even in these cases a propositional attitude is expressed (see also GS’s a analysis (section 6) of metalinguistic negation as a binary connective along this line). Recall that the propositional nature of the MC than-constituent is further evidenced in Korean by the use of the declarative marker la (or ta), which would be used even in cases like the ones here:

(iii) Pothong wuri-nun “darling”-la-kipota “dear”-la-ko han-ta.
    normally we-Top “darling”-Decl-saying than “dear”-Decl-Comp say-Decl
individual who is a parameter for the evaluation of predicates of personal taste and is only implicit; but the individual anchor expresses a parameter for evaluation that, unlike the judge, can be explicit—as is the case, e.g., of the embedded subject in mood choice and veridicality (Giannakidou 1998).

GS note that individuals other than the speaker may be plausible individual anchors; for instance, we can have a quantifier subject:

\[(22) \text{Kathe fititis pistevi oti o Pavlos ine perissotero glossologhos para filologhos.} \]
Every student believes that Pavlos is a linguist rather than a philologist.

Here, the individual anchor of comparison ranges over every student—a fact that is expected since we have overt embedding under a propositional attitude verb, which makes the embedded (in this case, quantificational) subject a possible anchor. These cases suggest that the notion of anchor is the one we need for MC, and not a judge (which tends to be implicit only).

A singular main clause subject can also serve as an anchor:

\[(23) \text{I Maria pistevi oti o Janis ine perisotero eksipnos para ergatikos.} \]
Mary believes that John is bright more than intelligent.

Here the MC can be anchored to the main clause subject, Maria, and need not be tied to the speaker only. This observation correlates with Lasersohn’s (2008) that, although the judge is typically the speaker, occasionally judges can be third parties; and likewise, it is reminiscent of Potts’s (2007) observation that expressive meaning, though typically anchored to the speaker, in embedding, may get associated with the embedded individual. In both accounts, these extraordinary associations of the anchor do not threaten the general validity of the claim that the anchor is typically the speaker. In our account, overt embedding under a propositional attitude makes additional anchors available, and there is no reason why these should not serve as appropriate evaluation parameters for the para clause.

This semantics captures the perspective dependence of MC, by putting all the action in the comparative morpheme (no attitude is argued to be syntactically present):

\[(24) \text{O Pavlos ine perissotero eksipnos para erghatikos.} \]
Paul is bright more than he is industrious.

\[(25) \text{TP = } 3d.\text{I believe to the degree } d \text{ that Paul is smart } \land \text{ } d > \text{ max}(\lambda d'.\text{it is I believe to the degree } d' \text{ that Paul is industrious}) \]

\[ \text{TP} \quad \text{ParaP} = \text{Paul is industrious} \]

\[ \text{MOREML} \quad \text{TP} \]

\[ \text{o Pavlos ine eksipnos} \quad \text{‘Paul is bright’} \]
The structure of the *para* clause in particular is given in (38):

\[
\begin{array}{c}
\text{ParaP} = \text{para o Pavlos ine erghatikos ‘than Paul is industrious’} \\
\text{P} \\
\text{para} \\
\text{FP} \\
\text{erghatikos} \\
\text{‘industrious’} \\
\text{F[E]} \\
\text{[uFoc*]} \\
\text{<TP>} \\
\text{<O Pavlos ine t>}
\end{array}
\]

We see that we have ellipsis of the TP in the *para* clause, consistent with the fact that clausal comparatives involve TP ellipsis in Greek.

If $\text{MORE}_{\text{ML}}$ gives attitude semantics, what is the contribution of *para* and *kipota*? So far, no special role is assigned to *para* (and likewise *kipota*), apart from being selected by $\text{MORE}_{\text{ML}}$. In section 5 we address the role of the particles themselves; but before we do so, we want to identify next a more “negative” version of $\text{MORE}_{\text{ML}}$ that is lexicalized in Korean.

4 Antiveridical metalinguistic comparatives in Korean

We claimed so far that the *kipota*-clause is like a *para*-clause: it introduces the second argument of $\text{MORE}_{\text{ML}}$. In Korean, there is no overt comparative morpheme, so we will hypothesize that $\text{MORE}_{\text{ML}}$ is there abstractly. At this point we would like to bring into the discussion the case of *nuni*. *Kipota*, just like Greek *para*, is emphatic and expresses dispreference towards the proposition it embeds—but this dispreference does not imply negation in the clause. If one wants to express a completely negative stance, *nuni* will be used with *charari*, which is equivalent to *rather* below:

\[
\begin{array}{c}
\text{Ku-wa kyelhonha-nuni (charari) nay-ka cwukkeyss-ta.} \\
\text{him-Dat marry-rather than rather I-Nom die-Decl} \\
\text{‘I would rather die than marry him.’}
\end{array}
\]

\[
\begin{array}{c}
\text{It is not preferable for me that I marry him and it is more preferable that I die.}
\end{array}
\]

As paraphrased here, the combination of *charari* and *nuni* brings about a completely negative attitude: the speaker’s strong unwillingness to accept the first proposition (that I marry him) by juxtaposing itself with another dispreferred proposition (that I die). This latter proposition is obviously also dispreferred under normal circumstances, but *in the context*, it appears as more preferable than the *nuni*-clause.

In Greek, the effect of *nuni* and *charari* is achieved with *para* and *kalitera*. But notice that in this case, the use of *apoti* is excluded:

\[
\begin{array}{c}
\text{Kalitera na pethano \{para/*apoti\} na ton pandrefto!} \\
\text{I would rather die than marry him!}
\end{array}
\]
The fact that in Greek *apoti* is excluded suggests that we are dealing here with a qualitatively different comparison from regular MC, where *apoti* and *para* are generally interchangeable.

We will assume here that *charari* entails some kind of negation, though it is not itself morphologically negative. We define *charari* below as the negative variant of MORE$_{ML}$ which imposes a total dispreference of the *q* argument, i.e., the proposition supplied by the *nuni*-clause. The negative component is added as a third conjunct in the underlined part in the formula in below:

\[
\lceil \text{charari} \rceil = \lambda \rho \lambda q \exists d \left[ R(\rho)(p)(d) \land d > \max(\lambda d'[R(\rho)(q)(d')]) \land \right.
\]
\[
\max(\lambda d'[R(\rho)(q)(d')]) = 0 \]
\]

where *R* is a gradable attitude provided by the context, expressing preference (desiderative or volitional); $\rho$ is the individual anchor of the attitude.

This definition renders *charari* a MORE$_{ML}$ that asserts zero preference of *q* by the speaker. Zero preference will render *charari* antiveridical (though not strictly speaking negative, since there is no negation). Antiveridicality alone is sufficient to license NPIs, as is shown in Giannakidou and Yoon (2008). Greek *para* is obviously compatible with the Neg-MORE$_{ML}$ meaning, and indeed in cases like (42) only this meaning is triggered. However, we cannot posit a covert Neg-MORE$_{ML}$ in this case because the *para*-clause generally does not license NPIs that need antiveridical licenser—unlike the charari (Giannakidou and Yoon 2008).

We have evidence, then, from Korean, Greek, and English that, when lexicalized, MC affects two positions: the comparative morpheme itself (MORE$_{ML}$, or Neg-MORE$_{ML}$), and the than- position. We find distinct lexicalizations in either or both positions, as we saw. We gave an attitude semantics for two variants of MORE$_{ML}$, and we are now finally ready to consider the contribution of the particle.

### 5 The expressive dimension of MC

When a speaker chooses to use *para*, *kipota* and *nuni*, the utterance becomes emphatic. The lexical choice is thus not redundant, or a mere reflex of syntactic selection, but rather a reflection of the speaker’s emotive stance. MC particles, we suggest, add the speaker’s heightened emotional perspective—a property typical of the class of expressive expressions such as *damn* and *bastard*, studied in Potts (2005, 2007).

The hallmark property of expressives is that when uttered, they have “an immediate and powerful impact on the context” (Potts 2007: 1). Almost invariably, “a speaker’s expressives indicate that she is in a heightened emotional state. They can tell us if she is angry or elated, frustrated or at ease, powerful or subordinated” (Potts 2007: 8). Potts call this property perspective dependence, and MCs exhibit this property clearly. Before offering our specifics of the idea that MC particles contain expressive content, we would like to elaborate just a little bit more on the properties of
the particles that we believe render them expressives. We are using here the typical properties of expressives we find in Potts (2007).

**Independence.** Expressive content contributes a dimension of meaning that is separated from the regular descriptive content:

(31) That bastard Kresge is famous.

This sentence asserts that Kresge is famous (descriptive meaning), and it also conveys that “Kresge is a bastard in the speaker’s opinion” (expressive meaning). One can accept the assertion as truthful without also accepting the characterization of Kresge as “bastard”. Potts argues that “the expressive and descriptive meanings that a sentence can convey should not be combined in single unit” (Potts 2007: 3), but also that “some expressive meanings act as bridges between the two realms, by mapping descriptive content to expressive content”. This is exactly how we envision the function of the MC particles.

**Nondisplacebility, ineffability.** Expressives always tell us something about the utterance situation itself, and cannot be used to report on past events, attitudes or emotions (Potts 2007: 5). This is what we find typically with MC particles:

(32) Kalitera na pethano **para** na ton pandrefto!
I would rather die than marry him!

(33) Ku-wa kyelonha-nuni (**charari**) nay-ka cwukkeyss-ta.
him-Dat marry-rather than rather I-Nom die-Decl
I would rather die than marry him’.

These sentences can only be understood with the possibility of undesired marriage as very imminent.

**Structural isolates.** Potts, and Potts and Roeper 2006 argue that expressives tend to not connect with the linguistic material around them, they are in this sense isolates: e.g. 'abso-fucking-lutely'. This property is certainly consistent with the predicate dropping and restriction to one remnant that we observed earlier with **para** clauses, as well as the fact that all metalinguistic particles are incompatible with the synthetic forms of the adjective. They exhibit in this case a discontinuity that can be seen as a manifestation of their expressive nature.

**Expressive indices.** Expressive indices are the main objects manipulated by expressive denotations. We are not going to elaborate on the whole system here, but we go directly to the definition that Potts offers (Potts 2007: (37)):

(34) An expressive index is a triple \(<a, b, I>\), where \(a, b \in D_e\) and \(I \in [-1, 1]\).

Expressive indices are the foundation for expressive domains, and are contained in expressives such as *damn*. These indices encode the degree of expressivity as well as the orientation of the expressive, and they are defined via numerical intervals \(I \subseteq [-1, 1]\). We can read \(<a, b>\) as conveying that individual \(a\) is at expressive level \(I\) for an...
individual b. Mapping emotional stance onto expressive intervals has the advantage of allowing flexibility from very neutral (if \( I = [-1, 1] \)—in Potts’s words, “a has no feelings for b”—to very negative. Emotive relations emerge as we narrow down I to proper subintervals of [-1, 1]; the more positive the numbers, the more positive the expressive relationship, and conversely. For example:

(35) a. \(<[[\text{tom}]] [[-.5, 0]] [[\text{jerry}] ]> \): Tom feels negatively toward Jerry

b. \(<[[\text{ali}]] [[-.8, 1]] [[\text{jerry}] ]> \): Ali feels essentially indifferent to Jerry

c. \(<[[\text{kevin}]] [[0, 1]] [[\text{jerry}] ]> \): Kevin is wild about Jerry

Expressive indices are just entities—this explains why they are not amenable to paraphrases (ineffability), but they have propositional implications: we see that from objects like \(<[[\text{tom}]] [[-.5, 0]] [[\text{jerry}] ]> \) we tend to infer propositions, in this case that Tom feels negatively toward Jerry. Importantly, the indices are built by relating two individuals by means of I; in our case, however, we will need to express the fact that an individual stands in an emotive relation to a proposition.

We noted that the emotional state is not constant across MCs, but ranges from mildly negative (para, kipota), to negative (nuni); we thus argue that para, kipota, and nuni contain expressive indices. We thus claim that the particles contain expressive relations between an individual and a proposition, and this is our innovation on Potts:

(36) **Expressive indices of metalinguistic comparative complementizers**

Nuni, kipota and para contain expressive indexes \(<a I q>, \) where a is the individual anchor, q the proposition they embed, and \( I \subseteq [-1, 0] \).

Para/kipota’s index ranges through the negative interval, at most approaching zero:

(37) a. para/kipota: \(<t, \varepsilon> : \) para/kipota combine descriptive content \( t \) (the type of propositions) and expressive content \( \varepsilon \).

b. \([[\text{para/kipota}]]c : \lambda p.p \) (identity function); c is the context

c. Expressive content of para/kipota in c:

Para/kipota contain an expressive index \(<a I q>, \) where a is the individual anchor, q the proposition they embed; and \( I \) ranges between [-1, 0].

With nuni we have an even narrower interval: the length of I cannot range more than -.5. This is the very negative part of the interval:

(38) a. nuni: \(<t, \varepsilon> \)

b. \([[\text{nuni}]] = \lambda p.p \) (identity function); c is the context

c. Expressive content of nuni in c:

Nuni contains an expressive index \(<a I q>, \) where a is the individual anchor, q the proposition it embeds; and \( I \) ranges between [-1, -.5].

What is important is to note here is that the semantic (in the sense of truth conditional) content and the expressive remain independent: truth-conditionally para/kipota and
nuni are mappings from propositions to propositions. The negative interval that they contribute in their index is not going to affect their truth conditional meaning—i.e. will not render them negative in the sense of antiveridical (Giannakidou 1998). In other words, a negative emotive stance to a proposition does not imply negating that proposition. This means that expressive force alone does not suffice to license NPIs:

(39) * That bastard Kresge said anything!

(40) *Kalitera na mino siopili, para na po KOUVENDA!

I’d rather be silent than say a word.


I-Top such-people anyone meet-rather than home be want-Decl

‘I would rather stay home than meet anyone among such a crowd.’

We see here that the negative expressive force of bastard does not suffice to license any; and in Korean and Greek, minimizers (which are strong NPIs and need an antiveridical licenser) are simply ungrammatical in para and nuni clauses. The negativity that comes the expressive intervals is not part of the descriptive content, where truth conditions are calculated. Improvement happens only if we add charari because it is antiveridical, as we argued earlier:


I-Top such-people n-person meet-rather than rather home be want-Decl

‘I would rather stay home than meet anyone among such a crowd.’

More on NPIs in Giannakidou and Yoon 2008. Here, it is important to emphasize that when we posit negative expressive force in the particles, we do not render them equivalent to negation.

5 Conclusion

In sum, our analysis claims that MC has two components: an attitudinal semantics, which is hosted in the comparative morpheme, and an expressive component that is manifested in the choice of than-particle. By embedding MC morphemes into the realm of expressives, our analysis achieves a natural coverage of at least this kind of metalinguistic interaction, and allows the hypothesis that perhaps all metalinguistic functions in language are combinations of attitudinal semantics and expressivity.
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References


Abstract

The paper looks at the Hungarian particle *ugye*, which has traditionally been classified as an interrogative particle but can also legitimately appear in declarative sentences in present-day Hungarian, and explores the possibility of assigning it a core interpretation that covers all of its uses and attributing apparent remaining differences between its meanings in the various sentence-types to intonation.

1 Introduction

The aim of the paper is to characterise the interpretation of the Hungarian particle *ugye*, which can equally appear in utterances having the force of a question or that of an assertion. (1-b), pronounced with the intonation shown in Figure 1, can be uttered in order to provide a felicitous answer to a question like (1-a), whereas the string-identical (2-a), pronounced with the intonation pattern shown in Figure 2, can be used to ask a question.

(1) a. Why is Thomas so upset?
   b. Mari Jánost léptette ugye elő.
      Mary John.ACC promoted PRT VM
      ‘As you know, Mary has promoted John.’

(2) a. Mari Jánost léptette ugye elő?
   b. Yes, she has.
      Mary John.ACC promoted PRT VM
      ‘Mary has promoted John, hasn’t she?’

Given the lack of substantial evidence for assuming that the syntactic structures of the string-identical (1-b) and (2-a) should be different (cf. É. Kiss (2002)), it seems to

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1 Note, importantly, that the contribution of *ugye* to the sentences intended as assertions and as questions must be translated differently into English. The particular choices made will be motivated later on.

2 The abbreviation ‘VM’ stands for *verbal modifier*. 
be a reasonable assumption that their different functions in the dialogues above should be attributed to their different intonational contours.

The above strategy runs into two difficulties, however. First, the differences between the intonations of (1-b) and (2-a) do not mirror those between ‘ordinary’ declarative sentences and their string-identical polar interrogative counterparts in Hungarian. According to the standard view (cf. Fónagy and Magdics (1967), Kornai and Kálmán (1988), Rosenthall (1992), among others), Hungarian declaratives are pronounced with a falling contour, whereas polar interrogatives bear a characteristic rise-fall on their penultimate syllable. Figures 3–4 illustrate the standard intonation of declarative and polar interrogative sentences without ugye, examples of which are shown in (3) and (4):

(3) Mari Jánost léptette elő.
Mary John.ACC promoted VM ‘Mary has promoted John.’

(4) Mari Jánost léptette elő?
Mary John.ACC promoted VM ‘Has Mary promoted John?’

(5) and (7) below, pronounced the way indicated in Figures 5 and 7, would both be substitutable for (1-b) in (1), as would (6) and (8), having the prosody indicated in Figures 6 and 8, be substitutable for (2-a) in (2).

(5) Mari ugye Jánost léptette elő.

(6) Mari ugye Jánost léptette elő?

(7) Mari Jánost léptette elő, ugye.

---

3The ToBI labeling of these examples closely follows the suggestions made by Rosenthall (1992) for analogous cases. Due to the lack of consensus concerning the appropriate representation of the system of Hungarian intonation in the ToBI framework (cf. Pierrehumbert (1980)), I have refrained from providing any labels for the rest of the examples, though.
(8) Mari Jánost léptette elő, ugye?

Figures 1-2 and 7-8 show that sentences with postverbal *ugye* that are intended to express questions differ from those intended to express assertions in that the former has a rise-fall pitch, analogous to the final rise-fall of ordinary interrogatives, falling exactly on the bisyllabic particle (cf. Figure 4 above), whereas the prosody of the latter does not differ from that of ordinary declaratives, cf. Figure 3. There is no rise-fall contour on the particle in sentences where it precedes an immediately preverbal pitch-accented focus constituent, but the prosodic difference between sentences of this type intended as questions, as shown in Figure 6 and assertions, in Figure 5, is still apparent.

In the rest of the paper, when we talk about declarative sentences containing *ugye* (ending in a period), we will mean those with a prosodic pattern analogous to that shown in Figures 1, 5 or 7. A question mark at the end of an *ugye*-sentence will indicate that its prosodic pattern is assumed to be analogous to those shown in Figures 2, 6 or 8.
The second difficulty in the way of providing a unified semantic interpretation for the particle is that sentence-internal *ugye* is traditionally viewed in the Hungarian literature as an interrogative particle, that is, as a sufficient means of creating the (form) type of interrogative sentences. (References include H. Molnár (1968), Kugler (1998)\(^4\), Keszler (2000).) The latter view is most certainly due to the (still transparent) etymology of the particle, according to which it is the result of composing the adverb *úgy* ‘so’ with the interrogative particle -e, which resulted in the interpretation ‘is that so?’. The occurrence of *ugye* in sentences that satisfy the criteria of the declarative form type (discussed below) is a relatively new phenomenon (first attested in 1923 according to Benkő (1995)), although quite a pervasive one (in spite of being under great attack by normative linguists).

In the rest of the paper, I wish to explore the possibilities for proposing an interpretation for sentences like (1-b) and (2-a) compositionally, by assuming a unique interpretation for the particle in both sentence-types, and attributing the difference in their illocutionary force potentials to their different intonation patterns. Section 2 looks at the use of the particle in what formally appear to be declarative sentences, and compares it to those of two German particles, whereas Section 3 is concerned with its use in sentences that have traditionally been classified as polar interrogatives. Section 4 describes two proposals for capturing the interpretation of the particle in a way that accounts for both of its usage patterns. The paper closes with the conclusions in Section 5.

2 **Ugye in declaratives**

The only work so far where the use of *ugye* in declaratives has been looked at is Péteri (2002), which argues that *ugye* has an interpretation there that is relatively similar to that of German (unaccented) *ja*. He characterises the difference between the two by saying

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\(^4\)Kugler (1998) mentions, however, that *ugye* also has a so-called *shading particle* use.
that with German *ja* the speaker only reminds the hearer of their common knowledge base, whereas with Hungarian *ugye* she also expresses the expectation that the hearer will agree with the propositional content of the sentence. Given the latter proposal, it seems reasonable that the search for the interpretation of *ugye* in declaratives should start with comparing its distribution to that of German *ja*, which seems to be well-described in the literature.

According to Zimmermann (to appear), adding *ja* to a sentence with a propositional content *p* indicates that the speaker considers *p* to be uncontroversial, that is, either being part of the common ground, or its truth being based on evidence that the speaker considers the addressee to be in possession of. The intended meaning of (9-a), containing *ja*, is adequately expressed in its Hungarian counterpart with the help of *ugye*, as shown in (9-b):

(9) **First brother to second brother:**

   a. Morgen wird Mama *ja* siebzig
      tomorrow turns mum **PRT** seventy
      ‘Mum turns 70 tomorrow, y’know.’ (from Zimmermann (to appear))
   b. Anyu *ugye* holnap hetven éves lesz.
      mother **PRT** tomorrow seventy years old be.3SG.FUT
      ‘As you know, Mum turns 70 tomorrow.’

The following examples, however, point to some differences between the two:

(10) **S is climbing the stairs in front of W.**

   a. W: Du *ja* ’n Loch im Armel.
      you have **PRT** a hole in sleeve
      ‘You’ve got a hole in your sleeve, you know.’ (from Lindner (1991))
   b. W: Van ( #ugye) egy lyuk az ingeden.
      be.3SG.PRT one hole the shirt.your.on
      ‘You’ve got a hole in your shirt.’

(11) **A: Maria is also coming along.**

   a. B: Sie ist *ja* verreist.
      she is **PRT** left
      ‘She has left.’ (from Karagjosova (2004))
   b. B: Nem, ō *ugye* elutazott.
      no he/she **PRT** VM.left
      ‘No, as you know, she left.’

On the one hand, the contrast between (10-a), which is compatible with a continuation of the form *Where?* on the part of the addressee, and the infelicitous (10-b) indicates that it is not enough for the licensing of *ugye* in an utterance that the speaker assumes that the addressee has enough evidence for judging the propositional content of the sentence to be true. On the other hand, the fact that (11-a) is infelicitous in the context indicated, whereas (11-b) could be felicitous if intended as a reminder shows that *ugye* is licensed if there is a way, according to the speaker, for the addressee to arrive at the truth of the proposition, given the information in the common ground. The asymmetries illustrated
above indicate that the conditions for the felicitous use of *ugye* are not equivalent to those of German *ja*.

The fact that in the context of (11), the version of (11-a) with the particle *doch*, illustrated in (12-b), is as felicitous as (11-b), might suggest that *ugye* has an interpretation that is more similar to that of German unaccented *doch*.

(12) a. A: Maria is also coming along.
   b. B: Sie ist doch verreist.
      she is PRT left
      ‘She has left.’ (from Karagjosova (2004))

The parallel etymologies of *ugye* and *doch* support the same conclusion. According to Hentschel (1986) (cited in Zeevat and Karagjosova (2007)), German *doch* is of Indo-Germanic origin, and is composed of the demonstrative *to*, the question marker –*u* and an emphatic marker *h*, and could therefore paraphrased as *That?* or *Is that so?*

According to Zimmermann (to appear) (based on work by Lindner (1991)), the use of *doch* in a declarative with propositional content *p* indicates the speaker’s assumption that the addressee is not aware of *p*, either because he has forgotten about it, or because he believes it to be false.

The above characterization for *doch* does not apply to *ugye*, however. On the one hand, as opposed to the case of (12-b), without the negative particle *nem* ‘not’, (11-b) cannot convey the interpretation that B’s utterance contradicts that of A. On the other hand, the two utterances of B in (13-a) and (13-b) give rise to different effects:

(13) *Employee*: Shall I come to work tomorrow?
   a. *Boss*: Du bist doch ernsthaft krank!
      you are PRT seriously ill
      ‘But you are seriously ill!’
   b. *Boss*: Te *ugye* súlyos beteg vagy!
      you PRT serious ill be.2SG
      ‘But you are seriously ill, as we know!’

According to the assumptions about the interpretation of *doch* summarized above, Boss’s utterance in (13-a) can only convey that he believes Employee to be temporarily unaware of his own serious illness. With the utterance of (13-b), however, Boss can express his doubt about whether the illness that Employee has previously reported to him is a reality. This is due to the fact that *ugye* does not serve the aim of explicitly indicating a contrast between the current utterance and the previous one, but summarizes instead what is in the common ground or what follows from it under normal circumstances according to the speaker, which leads indirectly to the contrast effect.

Thus, we have established that the distribution of *ugye* in declaratives neither corresponds to that of German *ja* nor to that of *doch*, which indicates that the semantic interpretation of the Hungarian particle cannot be equivalent to those of the German ones. Given that neither of the German particles is allowed to appear in polar interrogatives, cf. Thurmair (1989), this is actually a welcome result.
Based on the examples discussed above, the contribution of *ugye* to the interpretation of Hungarian declarative sentences seems to be best described as marking that, according to the speaker, the propositional content of the sentence follows due to default reasoning from the common ground. Given that $p$ is a proposition, Zeevat (2003) defines the truth of $\text{normally}(p)$ in an information state along the following lines: the truth of $\text{normally}(p)$ requires that the “$\text{CG} \models \psi_1, \ldots, \psi_n$, and that $\psi_1, \ldots, \psi_n$ together constitute a reason for thinking that $p$, while at the same time the $\text{CG}$ must not contain a reason for thinking that $\neg p$” (p. 183). Given the above definition, I propose that the contribution of *ugye* to the interpretation of Hungarian declaratives can be captured as follows:

(14) In a Hungarian declarative sentence with a propositional content $p$, given a $\text{CG}$, *ugye* marks that $\text{normally}(p)$.

Note, importantly, that the above characterisation of the interpretation of a declarative with *ugye* having a propositional content $p$ does not require that $p$ should be in the common ground. Otherwise, the contribution of speaker A in (11), for example, could only be interpreted as committing her to the truth of a proposition that stands in contradiction with the common ground, which is not the case.

Having made a proposal for capturing the interpretation of *ugye* in declaratives, we turn now to the analysis of *ugye*-sentences that have traditionally been classified as interrogatives in the literature.

3 *Ugye* in ‘interrogatives’

As mentioned in Section 1 above, *ugye* is viewed in many studies as a constituent that is responsible for the formation of interrogative sentences. In this section we take this view under close scrutiny. As also reviewed above, one characteristic type of polar interrogative main clauses in Hungarian has the same surface order as the corresponding declarative, cf. (3) vs. (4), differing from the latter in its intonation, as shown in Figures 3 and 4 above. The other characteristic type, illustrated in (15), is formed with the help of the interrogative particle -e, and has the same, falling intonation contour as declaratives:

(15) Mari volt-e Párizsban?
    Mary was-PRT Paris.IN
    ‘Has Mary been to Paris?’

The following example shows that *ugye* is not compatible with the interrogative particle -e:

(16) (*Ugye) Mari (*ugye) volt-e (*ugye) Párizsban (*ugye)?

The unacceptability of (16) can, naturally, be accounted for within the frameworks referred to above by saying that *ugye* and -e serve the same function, therefore their simultaneous appearance is either excluded by economy principles, or even blocked on syntactic grounds, for example, due to a principle regulating the filling of a functional head like $\text{Force}^0$ (cf. Rizzi (1997)).
The following examples illustrate, however, that the functions of the latter two particles are still not identical:

(17) Józsi tudja, hogy Mari volt-e Párizsban.
    Joe knows that Mary was-PRT Paris.IN
    ‘Joe knows whether Mary has been to Paris.’

(18) Józsi tudja, hogy Mari ugye volt Párizsban.
    Joe knows that Mary PRT was Paris.IN
    ‘Joe knows that, as you know, Mary has been to Paris.’

A comparison between (17) and (18) shows that only the particle -e is capable of indicating the interrogative status of an embedded clause. The subordinate clause of (18) can only be interpreted as a declarative. A further evidence for the dissimilar behaviour of polar interrogative main clauses with or without -e and ugye-‘interrogatives’ is that whereas the former do support negative polarity items, ugye is incompatible with these (cf. Gunlogson (2003)):

(19) Mari volt(-e) valaha is Párizsban?
    Mary was-PRT ever Paris.IN
    ‘Has Mary ever been to Paris?’

(20) #Mari ugye volt valaha is Párizsban?
    Mary PRT was ever Paris.IN
    ‘Has Mary ever been to Paris?’

The above data thus point to the conclusion that, as opposed to the standard view, ugye-sentences intended as question acts do not exemplify the interrogative form type. In this case, however, the question arises what the basis of viewing ugye as being responsible for the illocutionary force of the question in examples like (2-a) above is. The etymology of the particle, discussed above, as well as the fact that historically it first appeared in peripheral positions (sentence finally and then sentence-initially) makes it very similar to tags in various languages. The informal descriptions about ugye-‘interrogatives’, according to which they denote biased questions (cf. Károly (1957-62), Fonagy and Magdics (1967), Varga (2002), among others) give further support to viewing them as tag questions, most types of which are also attributed a biased question interpretation in the literature.

According to one dominant view, represented by Sadock (1974), Ladd (1981), Quirk et al. (1985), Reese and Asher (2006), and Reese (2007), among others, the biased question interpretation of most varieties of tag questions is due to the fact that they express two illocutionary acts at the same time: an assertion (due to the declarative sentence) and a question (due to the tag).

The latter claim has been supported by the application of Sadock (1974)’s diagnostics for illocutionary force. According to Sadock (1974), compatibility with the discourse marker after all signals that the sentence under consideration expresses an assertive act (at least), whereas compatibility with by any chance and tell me marks that

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5One notable exception are negative-anchor postnuclear tag questions, which can have an interpretation of neutral questions (cf. Ladd (1981), Reese and Asher (2006) and further references in the latter).
it expresses a questioning act (at least). The latter two diagnostics can also be used to discriminate between neutral and biased questions: whereas the former is restricted to neutral questions, the latter can appear with both. As the contrast between the following examples shows, Hungarian *mondd csak* ‘tell PRT’, behaves analogously to English *tell me*. (‘\' at the end of (21) is to distinguish the declarative sentence from its string-identical polar interrogative counterpart.) The translations of the Hungarian examples illustrate the relevant tests for English:

(21) *Mondd csak, János itt van.\`
     tell PRT John here is
     *‘Tell me, John is here.’

(22) Mondd csak, János itt van-e?
     tell PRT John here is-PRT
     ‘Tell me, is John here?’

The fact that (23) patterns with (22) as far as compatibility with *mondd csak* is concerned, indicates that it expresses a question (possibly among other illocutionary acts):

(23) Mondd csak, János ugye itt van?
     tell PRT John PRT here is
     ‘Tell me, John is here, isn’t he?’

Insertion of *véletlenül* ‘by any chance’ into the sentences above confirms that questions expressed with the particle *-e* are neutral, whereas those expressed by *ugye* are biased:

(24) János itt van-e véletlenül?
     John here is-PRT by any chance
     ‘Is John here by any chance?’

(25) *János ugye itt van véletlenül?* 
     John PRT here is by any chance
     *‘By any chance, John is here, isn’t he?’

Negative questions with *ugye*, which are compatible with *véletlenül*, seem to constitute an exception to the generalization above, and, therefore, seem to pattern with negative anchor postnuclear tag questions in English:6

(26) János ugye nincs itt véletlenül?
     John PRT be.NEG here by any chance
     ‘By any chance, John isn’t here, is he?’

Having shown that Hungarian sentences with *ugye* having ‘question-prosody’ do satisfy the tests proposed by Sadock (1974) for questioning acts, it remains to be seen whether they can also be proven to express assertive acts as well. There are some trans-

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6Reese and Asher (2006) account for the neutral question interpretation of the latter tag questions (available in addition to the biased question interpretation) by claiming that the negation of the anchor is to be interpreted as metalinguistic, that is, taking wide scope over an assertion operator. Limitations of space prohibit me from discussing the applicability of this kind of analysis to the Hungarian example in (26).
lation equivalents of the English discourse marker *after all*, such as *elvégre* or *mindennek ellenére*, that seem to be compatible only with sentences that express assertive acts:

(27) Elvégre János itt van.
    ‘After all, John is here.’

(28) *Elvégre János itt van-e?
    ‘*After all, is John here?’

(29) Elvégre János ugye itt van?
    ‘After all, John is here, isn’t he?’

The data discussed above thus suggest that *ugye*-sentences that can express question acts have an interpretation analogous to English tag questions, that is, they actually express a question and an assertion at the same time. This conclusion is strongly supported by prosodic data, discussed in Section 1, according to which *ugye*-sentences intended to express question acts differ from the corresponding declarative sentences with or without *ugye* in the melodic pattern of the particle itself, which resembles that of a one-word polar interrogative (disregarding the interaction of pitch-accented focus and *ugye* immediately preceeding it). This means that in structures where *ugye* appears sentence-medially, we are talking about an internalized tag. This raises, however, the question of how these sentences are also capable of expressing a simple assertion, as illustrated in (1-b). The next section will address this issue, by trying to disentangle the interpretation of the particle from that of the intonation.

4 Towards a unified interpretation for *ugye*

Having considered the relevant data concerning the interpretation of the particle *ugye* in declaratives and in tag questions, in this section we will explore the possibilities of integrating the two into one unified interpretation. There seem to be two ways this could be achieved. On the one hand, we could follow the path of the historical development and consider the interpretation of *ugye* in tag questions, described in Section 3, as basic and its contribution to sentences that have been classified as declaratives in Section 2 as a derived case. On the other hand, we could consider the interpretation of *ugye* in declaratives as basic, and describe its contribution to tag questions as the result of an interaction between the former meaning and the meaning of the question intonation on the particle.

Let us first assume that the particle *ugye*, that originated as an independent clause, but later became available for being integrated into the sentence structure, is to be analysed as a tag in all its occurrences. Semantically, this means that it always contributes a question to the interpretation of the sentence it occurs in that asks about the truth of the proposition \( p \) asserted by the rest of the sentence (the anchor). In the default case, the contribution of the particle to interpretation is mirrored by its intonation, which is analogous to that of a polar interrogative in Hungarian. How can this account be ex-
tended to cases where the intonation of an ugye-sentence is not to be distinguished from those of its declarative counterparts with or without ugye, and therefore the sentence can only be used felicitously to answer a question, as shown in (1-b), but not to ask one? Let us assume that low pitch on the particle has its standard iconic function, indicating confidence, assurance and certainty (cf. Ohala (1994)), in other words, the rhetorical question status of the question contributed by the tag. On these assumptions, an ugye-‘declarative’ could be taken to assert that \( p \) and assert that the answer to the question whether \( p \) holds is obvious. This characterisation more or less corresponds to the way the interpretation of ugye-declaratives was captured in (14) above. This approach, according to which ugye-sentences of all kinds are to be considered to belong to the same form-type, namely, tag questions, entails, naturally, that there cannot be any sentence containing ugye that is well-formed when pronounced with the question-intonation on the particle, but not when it is pronounced with low pitch, or vice versa. However, there are at least two types of examples, illustrated below, that are only well-formed when pronounced with low pitch on the particle:

(30) (Hát) én mit tehetek ugye?
PRT I what.ACC do.POSS.1SG PRT
‘What can I do?’

(31) Kár, hogy nem volt ugye idő.
pity that not was PRT time
‘It’s a pity that there was no time, as we know.’

(30) is a constituent interrogative with a rhetorical question reading where ugye (pronounced with low pitch) marks the truth of the proposition indirectly conveyed by the rhetorical question to be obvious, whereas (31) shows that it can appear in an embedded clause, which is not normally the case with tag questions.7

The above data indicating that the particle ugye is not equally compatible with all sentence types on both of its pronunciations brings us to the second proposal, which takes the interpretation of ugye in declaratives as basic and derives the interpretation of tag questions with ugye from the contribution of the anchor, from that of the particle, and from that of the question intonation on the particle. Let us assume that this basic interpretation of ugye is equivalent to that described in (14) above. According to this, the particle marks that the propositional content of the sentence it appears in is assumed by the speaker to be entailed from information in the common ground by default reasoning. If we want to make this the basic interpretation of the particle, and assume that localisation of the question intonation contour on a particular constituent means that it is only the contribution of the constituent to the meaning of the sentence is questioned (instead of the propositional content of the whole sentence), the interpretations of the three relevant parts of a tag question with ugye could be represented as follows:

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7There might also be a possibility of analysing (31) as an embedded root phenomenon, cf. Hooper and Thompson (1973). However, this analysis would also have to account for the obligatory low pitch on the particle.
(32) A proposal for capturing the interpretation of tag questions with *ugye*

<table>
<thead>
<tr>
<th>INTERPRETATION</th>
<th>Anchor</th>
<th><em>Ugye</em></th>
<th>Question intonation on <em>ugye</em></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>p</td>
<td>normally(p)</td>
<td>?normally(p)</td>
</tr>
</tbody>
</table>

According to (32), on the assumption that *ugye* has a basic meaning characterised in (14), tag questions with *ugye* would have to assert the propositional content \( p \) of the anchor, to assert that \( p \) follows from the common ground under default reasoning, and to question the truth of the proposition according which \( p \) follows from the common ground under default reasoning. Unfortunately, this proposal does not capture the intuitive meaning of tag questions with *ugye* correctly: the answer given to such a question by the hearer does not depend on whether he considers the propositional content \( p \) of the anchor to follow by default reasoning from the common ground, but on whether he considers \( p \) to be true or not.

## 5 Conclusion

The present paper investigated the interpretation of the Hungarian particle *ugye*, that can equally appear in sentences intended to express assertive acts as well as in those intended to express questioning acts. We have argued that in the former case, it has an interpretation of a context marker, whereas in the latter case it is to be interpreted analogously to English tags. Two attempts at unifying the interpretation of *ugye* across its two uses were explored, but both of them were found to run into some difficulties. This suggests that the particle has two distinct interpretations in the two sentence-types it can appear in, which are not to be derived from each other.

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Abstract
Objects of intensional transitive verbs (ITVs) can be interpreted transparently or opaquely. How to represent this ambiguity has been of considerable interest to the field over the years. This paper presents evidence from real-time sentence processing to weigh in on that debate. Our evidence supports approaches that rely in an essential way on a syntactic scoping mechanism to explain the ambiguity. Specifically, our evidence suggests that the object of an ITV is interpreted transparently only if it takes syntactic scope over the ITV. If it is inside the syntactic scope of the ITV, it is necessarily interpreted opaquely. Purely semantic approaches to the ambiguity cannot explain this strict dependency between syntactic scope and interpretation.

1 Introduction
A well-known property of intensional transitive verbs (ITVs) such as look for is that, unlike their extensional counterparts, e.g. have in (1), they give rise to an ambiguity with regard to their DP objects, (2), (Quine, 1960; Montague, 1973, etc.). In the transparent reading (2a), the DP a secretary has a specific or extensional reading, while in the opaque reading (2b), it does not.
(1) Mary has a secretary.  
(2) Mary was looking for a secretary.  
   a. a specific (e.g. the department) secretary  
   b. any secretary (e.g. to hire)  

A number of questions arise when considering how to formally characterize these readings. First, though both (1) and (2a) can be faithfully paraphrased within extensional first-order predicate logic as in (3) and (4a) respectively, the opaque reading has no adequate characterization in extensional terms, (4b):

(3) \[ \text{Mary has a secretary} = 1 \text{ iff } \exists x \left[ x \text{ is a secretary and Mary has } x \right] \]

(4) \[ \text{Mary was looking for a secretary} = 1 \text{ iff } \]  
   a. \( \exists x \left[ x \text{ is a secretary and Mary was looking for } x \right] \)  
   b. ???

This suggests that \textit{look for} denotes a modal operator, which creates an intensional environment, and that \textit{a secretary} can be interpreted in that environment. What the representational resources are that natural language uses to create intensional environments of this sort and how the interpretation of DPs can be made sensitive to them are open questions (Larsen et al., 1997; von Fintel & Heim, 2005, etc.).

For our purpose here, the central question is to what extent syntax feeds and bleeds the interpretation system responsible for opacity. We take it to be uncontroversial that an opaque interpretation requires the object DP to be in the scope of \textit{look for}. It is an open question, however, whether or not the transparent interpretation can be generated from the same syntactic structure. To see how a transparent interpretation might arise from a structure in which the object DP is in the scope of the ITV, we present an account, which we call the “world pronouns view,” based on Percus (2000). We contrast that approach with a more traditional account, the “strict-scope view,” according to which the transparent interpretation requires that the object DP be structurally higher than the ITV (Montague, 1973, etc.). Our experimental evidence clearly favors the second.

2 Opacity with ITVs

2.1 Opacity and Quantification

A fact about ITVs important for our argument is that typically only weak quantifiers like \textit{a} allow opaque readings. Strong quantifiers (\textit{every, most, the} etc.) do not (Zimmermann, 1993). As Moltmann (1997) argued, this can be seen clearly when comparing the felicity of strong and weak quantifiers in contexts that favor transparent, (5), or opaque, (6), readings.

(5) Who is Mary looking for?  
   a. Mary is looking for a secretary.  
   b. Mary is looking for the/every/most secretaries.
(6) What is Mary looking for?
   a. Mary is looking for a secretary.  \[Opaquexpr\]
   b. Mary was looking for every/the/most secretaries.  \[*Opaquexpr*]

In “transparent contexts” such as those introduced by a who-question, (5), we see that strong and weak quantifiers are equally felicitous. In “opaque contexts” such as those introduced by a what-question, however, only weak quantifiers are felicitous, (6a). The infelicity of (6b) suggests that strong quantifiers do not tolerate opaque interpretations.\(^1\)

Why that is so is not important for our purpose. However, that this is the case, is exploited in our experimental design.

### 2.2 A Possible Worlds Semantics for ITVs

A characterizing property of opaque readings with ITVs is that the object can have an empty extension in the actual world, without making the sentence necessarily false, (7). No such reading is available for extensional transitive verbs, (8).

(7) Mary was looking for a dragon.
(8) Mary found a dragon.

To capture this property, ITVs are analyzed as modal operators, which allow for the evaluation of predicates across possible worlds, thereby removing the commitment to existence in the actual world (\(w_0\)). NPs, in turn, denote properties (type \(\langle e, st \rangle\)), i.e. predicates whose denotation can vary across possible worlds. In extensional environments, NPs are evaluated with respect to \(w_0\), (9), while in intensional environments, with respect to the set of worlds that are made accessible by the modal operator. Assuming a Quinean paraphrase for **look for** as **try to find**, this set might be characterizable as the set of worlds in which Mary’s search (as defined in the actual world) is successful. For (7) to be true, then, existence of a dragon is required in those worlds but not necessarily in \(w_0\), (10).

(9) \[\llbracket \text{Mary caught a dragon} \rrbracket^w_0 = 1 \text{ iff } \exists x [x \text{ is a dragon in } w_0 \text{ and Mary caught } x \text{ in } w_0]\]
(10) \[\llbracket \text{Mary was looking for a dragon} \rrbracket^w_0 = 1 \text{ iff } \forall w [\text{Mary’s search in } w_0 \text{ is successful in } w \rightarrow \exists x [x \text{ is a dragon in } w \text{ and Mary finds } x \text{ in } w]]\]

With these ingredients in place, we can now sketch two approaches to the opaque/transparent ambiguity. The first relies on a syntactic scoping mechanism while the second relies on the possibility of leaving evaluation parameters such as world variables unbound even when they are in the scope of a suitable modal operator.

\(^1\)See Moltmann (1997) for special cases where strong quantifiers are interpreted opaquely.
2.3 Opacity via Scope

The first solution to the transparent/opaque ambiguity insists on a strict correspondence between the environment that the object DP occurs in and its interpretation (Montague, 1973). DPs that occur in an intensional environment, such as the scope of an ITV, are necessarily interpreted opaquely, (11), while DPs that occur in an extensional environment are necessarily interpreted transparently, (12).

(11) \begin{align*} & \llbracket \text{Mary was looking for a secretary}\rrbracket^{w_0} = 1 \text{ iff } \\
& \forall w \left[ \text{\text{m search in } w_0 \text{ is successful in } w \rightarrow x \text{ is a secretary in } w \text{ and } m \text{ finds } x \text{ in } w} \right] \end{align*}

(12) \begin{align*} & \llbracket [\text{a secretary}]^7 \llbracket \text{Mary was looking for } t_7 \rrbracket^{w_0} = 1 \text{ iff } \\
& \exists x \left[ \text{\text{secretary}(x) in } w_0 \text{ and } \\
& \forall w \left[ \text{\text{m search in } w_0 \text{ is successful in } w \rightarrow m \text{ finds } x \text{ in } w} \right] \right] \end{align*}

The mechanism that is standardly assumed to be responsible for mediating between these two structures is quantifier raising (QR), a covert movement operation that raises the object DP from its base position to a clausal node above the ITV.\(^2\)

(13) \begin{align*} & \text{Opaque C: What is Mary looking for?} & & \text{Transparent C: Who is Mary looking for?} \\
& \begin{tikzpicture}[scale=0.8] 
& \node (TP) at (0, 0) {TP}; 
& \node (DP) at (-2, -1) {DP}; 
& \node (Mary) at (-3, -2) {Mary}; 
& \node (T) at (-1.5, -2.5) {T}; 
& \node (VP) at (-1, -3.5) {VP}; 
& \node (looking for) at (-1.5, -4) {looking for}; 
& \node (a secretary) at (-2, -4.5) {a secretary}; 
& \draw (TP) -- (DP) -- (T) -- (VP) -- (looking for); 
& \draw (TP) -- (DP) -- (Mary) -- (T) -- (VP) -- (looking for); 
& \end{tikzpicture} \end{align*}

If a secretary occurs in its base position, it is in the scope of the ITV, (13) on the left.\(^3\) This results not only in a secretary being interpreted non-specifically (in the scope of the universal modal) but also in the evaluation index of a secretary being bound by look for. If the object DP is covertly moved outside the scope of the ITV, on the other hand, the existential takes scope over the modal operator and the evaluation index remains unbound, (13) on the right. Assuming a default rule that assigns \(w_0\) to unbound world variables, (von Fintel & Heim, 2005), this results in a specific and transparent interpretation of a secretary.

\(^2\)Montague’s term is “Quantifying in.” Following Fox (2002), we assume QR to be rightwards.

\(^3\)Note that the sister node of look for is simply labeled as XP in (13), indicating that its categorical status (CP, IP, QP, or NP) is not relevant for our purpose. All that we need is the possibility for object QPs to be interpreted in the scope of the ITV. This can be achieved by assuming that the complement position of ITVs is covertly clausal (Larsen et al., 1997), that ITVs take quantifiers as internal arguments (Montague, 1973), or that they take properties (type-shifted DPs) as arguments (Zimmermann, 1993, e.g.).
To capture the previously described distributional facts about quantifiers in this “strict-scope” view, it needs to be assumed that, for some reason, strong quantifiers lack a narrow scope LF and always undergo QR, as in (14).

(14) \[
[\text{[every secretary]}_7 [\text{Mary was looking for } t_7]]_{w_0} = 1 \iff \\
\forall x [\text{secretary}(x) \text{ in } w_0 \rightarrow \forall w [\text{m search in } w_0 \text{ is successful in } w \rightarrow \\
\text{m finds } x \text{ in } w]]
\]

### 2.4 Opacity via World Pronouns

Assuming, with Percus (2000), that world variables are not just evaluation parameters of the interpretation function but are, in fact, realized in the object language as pronouns, provides the representational flexibility for an alternative account of opacity. Rather than treating the ambiguity strictly as a matter of syntactic scope, this alternative exploits the possibility of leaving world pronouns unbound even when they are in the scope of a modal operator. For our cases, this means that an in-situ DP can, in principle, be interpreted intentionally, (15), as well as extensionally, (16), depending on whether the world pronoun introduced by the DP is bound by the ITV or defaulted to \( w_0 \).

(15) \[
[\text{Mary was looking for a secretary}]_{w_0} = 1 \iff \\
\forall w [\text{m search in } w_0 \text{ is successful in } w \rightarrow \\
\exists x [\text{x is a secretary in } w \text{ and m finds } x \text{ in } w]]
\]

(16) \[
[\text{Mary was looking for a secretary}]_{w_0} = 1 \iff \\
\forall w [\text{m search in } w_0 \text{ is successful in } w \rightarrow \\
\exists x [\text{x is a secretary in } w_0 \text{ and m finds } x \text{ in } w]]
\]

Note that in this system, even strong quantifiers, which presumably do not tolerate opaque readings for independent reasons, can stay in-situ. All that needs to be assumed to ensure a transparent interpretation for strong quantifiers, is that the world parameter associated with them cannot be bound by the ITV.

(17) \[
[\text{Mary was looking for every secretary}]_{w_0} = 1 \iff \\
\forall w [\text{m search in } w_0 \text{ is successful in } w \rightarrow \\
\forall x [\text{secretary}(x) \text{ in } w_0 \rightarrow \text{m finds } x \text{ in } w]]
\]

### 2.5 The Question

Though both approaches can account for extensional and intensional interpretations of objects of ITVs, they do so with very different mechanisms, and therefore assume fairly different underlying structures. While both theories agree that for an object DP to be interpreted opaquey, it needs to be interpreted in the scope of the ITV, they differ when it comes to the structures that give rise to transparent readings: in a strict-scope view, transparent object DPs must be QRed above the verb; in a world-pronoun view, transparent object DPs stay in-situ. Thus, distinguishing between these theories can be re-framed

\[\text{See below for discussion whether (14) can represent the transparent reading of a secretary.}\]
in terms of a question of structure: how we can distinguish QRRed structures from in-situ structures?

Since the purported movement of transparent object DPs is covert, there is no direct evidence from word order that would distinguish between these two proposals. Furthermore, for definite descriptions and universally quantified objects the in-situ and the QRRed structures predict the same truth-conditions. Definite DPs are scopally inert and since they are evaluated relative to the actual world when interpreted transparently, leaving them in-situ will result in the same truth-conditions as moving them above the ITV. Similarly, universally quantified DPs are scopally commutative with other universal quantifiers. Since ITVs express universal modal operators, scoping a universal object over it will yield the same truth-conditions as those that result when the object is left in-situ - again, as long as the object DP is evaluated relative to the actual world.

The only case, then, that might provide evidence for or against a scope-based account of transparent readings are indefinite objects. Scoping a secretary over the ITV will generate truth-conditions that are different from those that result when the indefinite DP is left in situ. The former structure, in (18a), yields a “specific” reading, while the latter, (18b), where a secretary is left in-situ yet evaluated in w₀, will result in a “non-specific de re” reading.

(18)    a. \[Mary was looking for a secretary\]^w₀ = 1 iff
       \[∃x[secretary(x) in w₀ and
            ∀w[m search in w₀ is successful in w → m finds x in w]]\]

 b. \[Mary was looking for a secretary\]^w₀ = 1 iff
       \[∀w[m search in w₀ is successful in w →
            ∃x[x is a secretary in w₀ and m finds x in w]]\]

The existence of non-specific de re readings for indefinite objects, cf. Fodor (1970), prima facie seems to suggest that we need the flexibility provided by a Percus style system. The existence of a specific reading, on the other hand, seems to suggest that we also need a scoping mechanism. However, things are more complicated than that. A defender of an in-situ view might, for instance, point out that the specific reading entails the non-specific de re reading and because of that, the specific reading might arise actually from the in-situ structure as a special case.⁵ A proponent of a strict-scope view, on the other hand, might propose a movement analysis of the non-specific de re reading by moving only the NP secretary while leaving the scopally active indefinite determiner a inside the scope of the ITV.

The upshot is that whether indefinites provide evidence for or against a strict scope view depends on the analysis of the specific and the non-specific de re reading. Since this is not a settled matter, a final evaluation of the evidence from indefinites cannot be given at this point. Similarly, transparent readings of definite and universally quantified objects are compatible both with in situ and as QR structures, and so provide no means of distinguishing between LFs. This means that off line data cannot distinguish between the two competing approaches.

In the next section, we show that evidence from real time sentence processing can

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⁵This is a general problem of wide scope indefinites.
distinguish the two approaches. More specifically, building on Koster-Moeller et al. (to appear), we argue that QR-ed and in situ structures have distinct processing implications for sentences with antecedent contained deletion (ACD). Building on those results, we then present processing evidence that strongly supports a strict scope view of transparent readings and that calls into question whether we need a Percus-style system of world pronoun binding.

### 2.6 Processing Antecedent Contained Deletion

The term antecedent contained deletion (ACD) refers to elided material, as in (19), that is properly contained within the expression that serves as its antecedent.

(19) John read every book Mary did ___.

In (19), the elided constituent is the VP inside the relative clause. Its antecedent is the matrix VP, which seems to contain as a proper part the DP that hosts the elided VP itself. From a general perspective on ellipsis licensing ACD is paradoxical because eliding a constituent is possible only if there is an identical/parallel constituent that serves as its antecedent. Obviously, an elided VP cannot be identical to another VP if the elided VP is a proper part of that VP. This, however, seems to be exactly what is going on in (19), making the acceptability of sentences like (19) on-face paradoxical.

The paradox can be resolved if the sentence is reconfigured using QR. Specifically, if the DP hosting the relative clause, which contains the elided VP, is moved above the matrix VP the ellipsis site is no longer contained within its antecedent, (cf. Sag, 1976; Kennedy, 1997, etc.), (20).

(20)

For our purposes here, it is important to note that in ACD structures, QR occurs regardless of the semantic properties of the DP. Normally, QR of an object DP occurs only if the object DP is quantificational. Quantificational DPs are not directly interpretable in their base position due to a type-mismatch (Montague, 1973). QRing the
object resolves that type-mismatch (May, 1985; Fox, 2003, etc.). In ACD structures, however, the motivation for QRing the object DP is to undo antecedent containment. Hence, QR of an object DP hosting an ACD site happens independently of whether or not the DP itself is quantificational.

These two types of triggers for QR can be distinguished in a left-to-right real time sentence processing paradigm, since the parser encounters the determiner, whose semantic properties determine whether or not the object DP is quantificational, before it encounters the ACD site. Importantly, if the determiner of the host DP is quantificational, QR is triggered at the point where the parser encounters the determiner. This incurs a processing cost due to movement (Varvoutis & Hackl, 2006). The ACD site downstream would be only a second trigger for the same operation and since QR has already occurred, incurs no additional processing cost. However, if the determiner of the host DP is definite, QR will not be triggered until the parser encounters the ACD site, incurring the additional processing cost of movement at the ACD site. Thus, we can use a relative increase in processing cost of an ACD site as means to detect whether the host DP has been previously QRed or not: specifically, object DPs that undergo QR facilitate downstream ACD processing, while those that remain in situ do not.

In a self-paced reading study, Koster-Moeller et al. (to appear) demonstrate these processing implications using the paradigm exemplified in (21).

(21) The secretary was trained to manage...
   a. the/every program that the intelligent young professional designed
   b. the/every program that the intelligent young professional did

...during her four years at college.

The logic behind this design exploits the linear dependency between QR and ACD as discussed above. Specifically, comparing processing costs for ACD sites, (21b), relative to an identical baseline, (21a), across two determiner conditions reveals a relative advantage for the quantificational determiner because it triggers QR, thereby preparing the parser for an ACD site downstream. The definite determiner, on the other hand, does not trigger QR. Hence, the ACD site itself is the first time the parser encounters a trigger for QR, resulting in a larger increase in processing cost for the ACD relative to the baseline. As can be seen in figure (22), this is exactly what Koster-Moeller et al. (to appear) found.

The graph in (22) displays reading times two words after the verb/ellipsis site in two determiner conditions. We see that there is a significant increase in RTs for the ACD condition for the definite determiner. For every there is no significant difference in RT between the ACD and the verb conditions. An interaction of this sort suggests that no additional processing cost was incurred when the parser reached the ACD site in the latter case. This, in turn, suggests that encountering a quantificational object triggers QR, facilitating processing in the ACD site.

We can turn this logic around, using ACD reading times to test for whether the host DP has independently undergone QR. Specifically, a relative increase in reading time two words after the ACD site suggests that the host DP has been interpreted in situ.

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6However, see Montague (1973), Jacobson (to appear), Barker (2002), etc. for alternatives to resolve the type-mismatch.
No relative increase of this sort, on the other hand, suggests that the host DP has been QRed for independent reasons. The next section shows how we can apply this logic to the question of the ambiguity in ITVs.

3 A Processing Study of Opacity

3.1 Experimental Design: Intensionality and ACD

We can distinguish the strict-scope approach to ITVs from the world-pronoun approach in terms of their predictions for down-stream ACD resolution. For a sentence like (23), which contains both an ITV and an ACD site, the two approaches make different processing predictions for the facilitation of processing the ACD site. Specifically, a strict-scope account predicts an interaction between the opacity of the object DP and ACD, such that transparent readings (which in this view require QR) will facilitate ACD resolution down-stream. A world-pronoun approach, on the other hand, assumes that QR never needs to occur until the ACD site. This predicts a main effect of ellipsis, because ellipsis resolution is never facilitated and so will always be harder than processing a verb.

(23) Mary was looking for a secretary that John was.

We tested these predictions using the following 2-Factor (Determiner by Ellipsis) design. We used three determiners, the weak indefinite *a*, and the strong quantifiers *the* and *every*. We paired each of these with two verb conditions, one with an ACD site, (a), and one with a basic verb, (b), giving rise to six total conditions.

(24) The producer was looking for ...
    a. an/the/every actress that the director **was**
    b. an/the/every actress that the director **wanted**

...before finalizing the casting list.
3.2 Predictions

Using this paradigm, we can make explicit predictions for each theory. In a strict-scope view, *the/every* always undergo QR because they are not compatible with an opaque reading. Thus, unlike in the extensional cases of Koster-Moeller et al. (to appear), where we saw only the quantifier to facilitate ACD processing, both *the/every* do that with ITVs. The indefinite *a*, however, facilitates ACD only when the ITV-object is construed transparently, triggering QR, and not when construed opaquely, staying in situ. In other words, for transparent environment, a strict scope account predicts that ACD resolution will be no harder than basic verb resolution for all three quantifiers (as they all undergo QR), while in an opaque environment, it predicts that ACD resolution for indefinites will be noticeably harder (as they do not undergo QR).

This contrasts noticeably with the predictions made by a world-pronoun view. In that view, none of *the, every*, or *a* trigger QR, and thus will not facilitate ACD processing, in either a transparent or opaque environment. This predicts that for all three, ACD resolution is noticeably harder than verb resolution.

3.3 Methods and Materials

To investigate whether real time processing of intensional transitive verbs interacts with ACD as discussed above, we use the self-paced, word-by-word moving window reading methodology (Just et al., 1982).

Our target items were constructed following the sample paradigm in (24). The matrix verb was always in the past progressive to allow for ellipsis resolution triggered by *was* in the relative clause.

Adverbs and adjectives were inserted between the object DP and the main point of interest (the verb or auxiliary in the relative clause) to prevent spillover effects from
the different determiners interfering with processing difficulties that might arise at the 
point of interest.

We constructed 60 target sentences, which were combined with 120 fillers of 
various types. These included sentences that were similar to the target items in structure 
(employing relative clauses, elided material or covert movement triggers), in length, or 
because they contained quantifiers. The items were counterbalanced across six lists using 
a Latin-square design. Items were pseudo-randomized separately for each participant, 
with at least one filler sentence preceding each target.

65 undergraduates from the Claremont Colleges were tested on Dell PCs running 
the Linger software developed by Doug Rohde. All were native speakers of English and 
received course credit or $10.00 cash for their participation.

3.4 Analysis and Discussion

Following standard procedure, residual reading times (rRTs) were calculated to adjust 
for word length and differences in participants’ natural reading rates. RRTs beyond 
two standard deviations were excluded from analysis and only rRTs from items whose 
follow-up question was answered correctly were included in the final analysis. Participants with less than 75% accuracy were excluded, (n = 5) and rRTs over 200 ms were 
trimmed.

Additionally, in order to test the predictions made by each theory for both the 
opaque and transparent environments, we separated participants into two groups, the 
“Transparent” group, whose rRTs were longer when the indefinite was accompanied by 
a verb than when accompanied by an ellipsis site (a-verb > a-was), and the “Opaque” 
group, whose rRTs were not (a-verb ≤ a-was):

\[
\text{a-verb} > \text{a-was} \rightarrow \text{Transparent (n = 28)}
\]
\[
\text{a-verb} \leq \text{a-was} \rightarrow \text{Opaque (n = 32)}
\]

This criterion provides an effective way of dividing participants into those that only got 
transparent readings for ITVs and those that also got opaque readings - without biasing 
the results. Specifically, as only the strict scope view predicts any difference between 
the opaque and transparent conditions, the Opaque group includes all participants who 
employ a world-pronouns solution, as well as any participants who, using a strict-scope 
semantics, construed the indefinite opaque. Thus, the only participants who were sep-

3.5 Results

Looking at the Opaque group, we see a prominent separation of reading times across 
conditions at the region of interest, two words after the ellipsis site (marked by ORDER 
in Figure 1). A repeated measures ANOVA (Determiner by Ellipsis) reveals a significant 
interaction, $F(2,29) = 3.830; p < .033$. We see that the interaction is driven by the high 
reading time of the indefinite in the ellipsis condition \(a-was\), specifically by a det*ell
interaction for a/every and a/the, $F(1,30) = 6.991; p = .013$, and $F(1,30) = 5.635; p = .024$, respectively, Figure 1.

![ITVs: Opaque DPs (n = 32)](image1)

**Figure 1:** Residual Reading Times: Opaque Group

However, in the Transparent group, we see no significant differences between any conditions at the area of interest (all $p > .5$), Figure 2.

![ITVs: Transparent DPs (n = 28)](image2)

**Figure 2:** Residual Reading Times: Transparent Group

We can see the results of the experiment more clearly looking at a pullout of the area of interest, which presents the residual readings times for each determiner in the verb condition (\textit{Ved}) and the ellipsis condition (\textit{Ell}), Figure 3. Specifically, for the Transparent group, we see that the ellipsis condition is as easy as the verb condition for all determiners. Based on Koster-Moeller et al. (to appear), this indicates facilitation of ACD in all three determiner conditions, i.e. that all three determiners have undergone QR. For the Opaque group, we see no significant difference between \textit{every} and \textit{the}, but
a significant difference for \(a\). This indicates that QR occurred upstream for both \(\text{every}\) and \(\text{the}\), but not for \(a\), Figure 3.

![Graph showing Transparent DPs: Area of Interest](image)

![Graph showing Opaque DPs: Area of Interest](image)

Figure 3: Area of Interest: two words after the gap

Recalling the original predictions, we see that results from both the Transparent and Opaque group strongly support a strict scope analysis of intensional transitive verbs. In the Transparent group, only a strict scope view predicts QR (ease of ACD resolution) for all three determiners. A world-pronoun view would predict no facilitated ACD resolution for any determiner. In the Opaque group, both views predict that the indefinite \(a\) remains in-situ, but only a strict-scope view predicts that both \(\text{every}\) and \(\text{the}\) undergo QR and facilitate ACD processing downstream.

The fact that both \(\text{every}\) and \(\text{the}\) facilitate ACD resolution contrasts noticeably with the results of Koster-Moeller et al. (to appear), who found facilitation of ACD resolution only for \(\text{every}\) but not for \(\text{the}\). The difference between these two experiments is the choice of matrix verb: Koster-Moeller et al. used extensional transitive verbs while the present study used intensional transitive verbs. For extensional verbs only true quantifiers require QR to resolve a type-mismatch. Since definite DPs do not give rise to a type-mismatch in object position, they do not trigger QR and, hence, do not facilitate ACD resolution. For intensional verbs, however, our study shows that any DP that does not tolerate an opaque construal undergoes QR, whether or not the DP is quantificational. Importantly, these results are predicted only by a strict-scope view of opacity, which relies essentially on syntactic movement to account for the transparent/opaque ambiguity.

4 Conclusion

This paper presented real time sentence processing evidence weighing in on the correct analysis of intensional transitive verbs. We discussed two accounts, differing in their
treatment of the transparent/opaque ambiguity. One employs syntactic movement, while
the other has no direct implication for the syntax but relies on the representational flex-
bility introduced by treating world variables as object language expressions. We argue
that only the former approach can account for our experimental results, namely an in-
teraction between the interpretation of an object DP and its ability to facilitate ACD
resolution. From this, we conclude that any analysis of the ambiguity must essentially
rely on a syntactic mechanism to account for the available interpretations of the objects
of ITVs.

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Comparison in Turkish: A Rediscovery of the Phrasal Comparative

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Abstract
This paper argues that clausal comparatives are completely unattested in Turkish and thus verifies the need for a genuinely phrasal analysis of comparison constructions in this language. It develops such a syntactic and semantic analysis that differs considerably from ‘standard’ analyses commonly suggested for languages like English and also shows that this phrasal analysis derives the correct predictions for the scopal behaviour of quantified DPs and the comparative operator. It furthermore argues that phrasal comparatives are the ‘basic’ and potentially universal type of comparatives, in contrast to what has been hypothesised previously, and speculates on how this phrasal analysis might even be applied to solve problems for analysis with English comparatives.

1 Introduction

At least for languages like English and German, there has been a strong tendency in recent linguistic literature to analyse apparently phrasal comparatives featuring nothing but a single noun phrase (or determiner phrase) in the standard term against which the comparison is made such as

(1) a. Mary ran faster than Peter.

by deriving them from an underlyingly clausal source (cf. e.g. Lechner (2004) and references therein). Under such an analysis, the element expressing the gradable property is either copied and subsequently deleted in the than-clause, or moved directly to the matrix clause:

(1) b. Mary ran fast-er/fastɪ-er than Peter ran d-fast/t.”
Such approaches do away with the need for a special phrasal analysis for examples like (1a) and allow us to treat phrasal and clausal comparatives alike. A question that naturally comes to mind, then, is whether this uniform way of analysing all comparatives is only valid for a particular group of languages, or whether it even holds cross-linguistically.\footnote{As a matter of fact, even the first and weaker part of this assumption is far from being uncontroversial, as will be shown for English in section 6 below.}

Based on findings from a large-scale empirical study on comparison constructions in Turkish, in which I investigated the variety of possibilities to express a comparison in this language by interviewing a substantial number of native speakers on more than 150 sentences each to obtain a thorough amount of positive and negative evidence alike, I should like to argue that the latter is clearly not the case: After introducing some basic Turkish data in section 2, I shall show in the following section that this language is characterised by a total lack of clausal comparatives altogether, so that the ‘standard’ syntactic and semantic analysis commonly suggested for comparatives in English-like languages cannot be applied to Turkish comparatives, which, in turn, require a genuinely phrasal approach that I shall develop in section 4. As a next step, I shall produce additional evidence for this analysis by testing the predictions it makes with respect to the scopal behaviour of the comparative operator and quantified determiner phrases (section 5). In section 6, I shall then make a few comments on what the Turkish data make us expect for the cross-linguistic distribution of phrasal and clausal comparatives that contrast sharply with the assumptions presented in Bhatt & Takahashi (2007). Section 7 finally concludes this paper and speculates on how the phrasal analysis developed for Turkish comparatives, here, might also be transferred to languages like English and solve a couple of long-standing problems such as the proper analysis of comparatives featuring quantified determiner phrases in the standard term, there.

2 Comparative Constructions in Turkish – Some Basic Data

Before going into details and taking a look at particular pieces of data in the following sections, I should like to give my readers a first impression of what an ‘ordinary’ Turkish comparative looks like, here. As can be seen from the predicative comparative in (2), in Turkish, comparatives typically consist of (at least) a comparee term (Maria), a standard term that has to appear in the ablative case (Peter’den) and a gradable predicate (the adjective uzun).\footnote{With present tense, the copula is usually left out in Turkish, and in fact, insertion of the corresponding form dur would rather decrease than increase the well-formedness of (2) according to my informants.} Exx.

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\footnote{Readers familiar with Turkish might miss the element daha here, which often appears in comparatives in this language and seems to trigger a wide range of semantic effects (with ‘ordinary’ comparatives, it usually increases the difference between the standard and the comparee term, in comparatives lacking an overt standard, it seems to express the fact that we are dealing with a comparative as such, and in comparatives with an overt differential, it does not seem to make any contribution to meaning whatsoever). Given that this element is rather irrelevant for my present purposes and that its omission...}
(2) Maria Peter’den uzun.
   Maria Peter.Abl. tall
   ‘Maria is taller than Peter.’

(3a) constitutes an example of an adverbial comparative, featuring the adverb hızlı⁴ and an overt verb form (koştu) occupying a position at the very end of the sentence (note that Turkish is a head-final language):

(3) a. Maria Peter’den hızlı koştu.
   Maria Peter.Abl. fast run.Past.3Sg.
   ‘Maria ran faster than Peter.’

Finally, I should also like to introduce an example of an equative (4), which displays the same basic structure as its comparative counterpart (2), the only difference being the equative operator kadar, which has been added in the appropriate position as well as the fact that Peter no longer takes an ablative case morphology:⁵

(4) Maria Peter kadar uzun.
   Maria Peter as...as tall
   ‘Maria is as tall as Peter.’

For lack of space, I need to limit myself to these very few examples here and refer the interested reader to Beck et al. (to appear) for further Turkish data including superlatives, the positive, differential comparatives, degree questions, etc. and a lot more.

3 The Overall Absence of Clausal Comparatives in Turkish

When trying to decide whether the overall clausal analysis of comparatives often suggested for English-like languages and sketched in the introductory section above can be transferred to Turkish or not, the first thing to be checked is whether a phrasal comparative such as (3a) can be assigned a corresponding clausal source underlying it. As it turns out, though, this is not the case, as the ungrammaticality of (3b) clearly indicates:

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⁴ What I mean by ‘adverb’, here, is nothing more than that this element performs the function of a canonical adverb in (3a). From a morphological point of view, it is usually impossible to distinguish between adverbs and adjectives in Turkish, both sharing the same basic form.

⁵ This is probably due to the fact that the overt operator kadar sufficiently marks the entire construction as an equative, whereas there is no corresponding explicit comparative operator in examples like (2) or (3a) above, so that the ablative case marking on the standard term is obligatory here to mark the comparative quality of the whole construction in the first place.
(3) b. *Maria Peter’den (hızlı) koştu hızlı koştu.
   Maria Peter.Abl. (fast) run.Past.3Sg. fast run.Past.3Sg.
   intended as: ‘Maria ran faster than Peter ran.’

People might object at this point that sentence (3b) might simply be out due to a stylistic awkwardness arising from the immediate repetition of (hızlı) koştu. However, avoiding this repetition by choosing two distinct verbs in the matrix clause and the subordinate clause, respectively, does not improve the well-formedness of comparatives featuring a clausal standard in the least:

(5) *Maria Hans (sesli) ıslık çalmadı sesli şarkı söyledi.
   Maria Hans (loud) whistle.Past.3Sg. loud sing.Past.3Sg.
   intended as: ‘Maria sang louder than Hans whistled.’

Conversely, English standard terms that are clausal in nature typically translate as nominalisations into Turkish, as shown in (6), where the possessive pronoun benim directly preceding düşündüğümden as well as the ability of the latter element to adopt a case ending indicate that the deverbal düşündüğümden has indeed taken on nominal characteristics and functions as a noun in (6):

(6) Maria benim düşündüğümden zengin.
   Maria my think.Ptcple.1Sg.Abl. rich
   ‘Maria is richer than I thought.’

Interestingly enough, the unavailability of clause-like standard terms in Turkish comparatives is not just an isolated phenomenon as such, but matches the fact that finite subordination is generally unattested in the Turkish language, and that canonical subordination constructions in English-like languages such as relative clauses (7) or complements of verbs of perception and thinking (8) typically correspond to Turkish constructions featuring essentially the same nominalisation pattern as the one attested in the comparative in (6) above:

(7) Maria’nın aldığı kitap enteresan.
   Maria.Gen. buy.Ptcple.3Sg. book interesting
   ‘The book bought by Maria is interesting.’

(8) Yağmur yağdığına eminim.
   rain(N) rain(V).Ptcple.3Sg.Postp. think.Pres.1Sg.
   ‘I think (that) it is raining.’

Within the domain of comparison constructions, this complete lack of finite subordination in Turkish leads to an interesting prediction: Given that subdeletion structures are always inherently clausal in nature, this type of construction is predicted
to be entirely absent from a language like Turkish, and this prediction is indeed fully borne out, as the ungrammaticality of (9) below confirms:6,7

(9) * biçak çekmeceden derin uzun.
knife drawer.Abl. deep long
intended as: ‘The knife is longer than the drawer is deep.’

4 The Syntax and Semantics of English vs. Turkish Comparison Constructions

In this section, I shall develop a syntactic and semantic analysis appropriate for dealing with comparison in a language like Turkish. To do so, I shall first of all briefly sketch the analysis standardly assumed for comparatives in English-like languages8 to show that this type of analysis cannot be successfully transferred to Turkish, thereby verifying the need for a genuinely phrasal analysis to cope with Turkish comparison constructions, and finally, I shall try and establish such a phrasal approach.

As already mentioned in the introduction, the standard analysis for comparative constructions in languages like English parts from the basic assumption that all comparatives (including those that feature nothing but a single nominal expression in the standard term) instantiate an underlyingly clausal standard of comparison. It is furthermore assumed that the matrix clause as well as the (standard) subordinate clause each provide a set of degrees and that the comparative operator then forms their maxima and compares these, as can be seen from the lexical entry for this operator:

(10) \[[\text{Comp.Op}_\text{Eng}] \equiv \lambda D_1 \in D_{<d,t>} \cdot \lambda D_2 \in D_{<d,t>} \cdot \max(D_2) > \max(D_1)\]

Moreover, gradable adjectives and adverbs are generally taken to denote relations between individuals and degrees, as shown in the model lexical entry for fast in (11):9

6 Since sentences like (9) are perfectly ungrammatical, it is sometimes difficult to establish such negative evidence with native speakers. What (9) represents is the most plausible word order for subdeletion structures, if this phenomenon really existed in Turkish. In the elicitation process, however, I also checked several other structures to make sure that sentences like (9) are not just out for reasons of a simple word order violation.

7 This is not to say that subcomparative concepts as such cannot be expressed in Turkish at all, but just that different strategies like nominalisations (cf. (i) below) would have to be used and that gradable elements as such cannot form a subcomparative:

(i) biçak çekmecenin derinliğinden uzun.
knife drawer.Gen. depth.Abl. long
‘The length of the knife exceeds the depth of the drawer.’

8 Doing so, I shall by and large follow Beck (to appear, subsection 2.1).

9 In what follows, I shall be careless enough to simply write “x is d-fast” and the like in order to save space, although I do assume monotonicity, which will play a crucial role in section 5 below.
(11) \[ [[\text{fast}]] = \lambda d \in D_d, \lambda x \in D_c. \text{speed}(x) \geq d/x \text{ is } d\text{-fast} \]

In (12), I present the logical form for sentence (1a) from above, including semantic types as well as partial calculations:\(^{10}\)

(1) a. Mary ran faster than Peter.

(12)

As readers may easily check for themselves, (1a) is thus predicted to be true iff ‘max(\(\lambda d. \text{Mary ran d-fast}\)) > max(\(\lambda d. \text{Peter ran d-fast}\))’, which corresponds exactly to what this sentence intuitively means.

\(^{10}\) I try to keep this representation as simple and straightforward as possible and therefore, I do not take more recent developments in syntax into account that do not directly affect the point I am trying to make, here.
From what has been argued for in section 3 above, it should immediately become obvious that this analysis cannot be transferred successfully to Turkish, because it crucially hinges on the presence of a clausal standard term, which is never the case with comparatives in Turkish. What I suggest instead is the following genuinely phrasal analysis inspired by the one proposed in Heim (1985, cf. in particular pp. 5-7 and the appendix), which I adapted to the special needs of Turkish syntax and also modified in order to take later developments in the analysis of comparatives into account: I stick to the assumption according to which gradable adjectives and adverbs denote relations between individuals and degrees (cf. the model entry for fast in (11) above), but in Turkish, I assume that, instead of furnishing a set of degrees, the standard term provides us with an individual which relates to another individual in the matrix clause and that the comparative operator then forms and compares the maximal degrees to which these two individuals possess a quality, perform an action, etc., as specified in the matrix clause, which can be seen from its lexical entry, given in (13):\(^{11}\)

\[(\text{13}) \quad \text{[[Comp.Op.}_{\text{Turk}}]} = \lambda x \in D_e. \lambda A \in D_{<d,<e,t>}. \lambda y \in D_e. \max(\lambda d. A(d)(y)) > \max(\lambda d. A(d)(x))\]

In (14) below, readers will find the logical form for sentence (3a), where I once again include types and part of the actual semantic calculation, so that it can easily be seen that (3a) will come out true iff ‘max(\lambda d. Maria ran d-fast) > max(\lambda d. Peter ran d-fast)’, and (14) thus derives the correct truth conditions for this sentence.\(^{12}\)

\[(\text{3}) \quad \text{a. Maria Peter’den hızlı koştu.}\]
\[\begin{array}{c}
\text{Maria}\quad \text{Peter.Abl}\quad \text{fast run.Past.3Sg.}
\end{array}\]
\[\text{‘Maria ran faster than Peter.’}\]

\(^{11}\) Kennedy (to appear, subsection 3.1) posits essentially the same lexical entry for a phrasal comparative operator as (13) above, and Bhatt & Takahashi (2007, p. 21; to appear, subsection 1.2) also suggest a similar lexical entry. Whereas the entry I propose in (13) is along the lines of von Stechow (1984) (in the version adopted in Heim (2001, pp. 214-217) and Beck (to appear, subsection 2.1)), Bhatt and Takahashi posit a lexical entry for the comparative operator in the tradition of Seuren (1973), which, in my opinion, however, has serious shortcomings when it comes to analysing comparatives featuring an explicit differential.

\(^{12}\) The logical form in (14) might at first glance look a bit odd, given that the second instantiation of movement targets a position between the first moved element and its binder index, so that we are dealing with a sort of ‘parasitic’ movement (cf. Kennedy (1997, pp. 170-174; to appear, section 3.3) and Bhatt & Takahashi (2007, pp. 21f.; to appear, subsection 1.2), here. As Beck & Sauerland (2000, in particular pp. 263f.) have argued, however, this special movement strategy is also indispensably at work with cumulative interpretations of relational plurals in combination with definite numerals, indefinite numerals as well as coordinations of proper names, so that there is independent motivation for it anyway and does thus not constitute a mere stipulation for analysing comparatives.
With only slight modifications, this phrasal analysis for ‘ordinary’ comparatives then translates in a simple and straightforward manner to other comparison constructions. If I posit the lexical entry given in (15) for the equative operator \textit{kadar},

\begin{equation}
[[\textit{kadar}]] = \lambda x \in D_e. \lambda A \in D_{<d,<e,t>}. \lambda y \in D_e. \max(\lambda d. A(d)(y)) \geq \max(\lambda d. A(d)(x))
\end{equation}

sentence (4) from above

\begin{itemize}
\item[(4)] Maria Peter \textit{kadar} uzun.
\item Maria Peter as...as tall
\item ‘Maria is as tall as Peter.’
\end{itemize}

will e.g. properly be predicted true iff ‘\(\max(\lambda d. \text{Maria is } d\text{-tall}) \geq \max(\lambda d. \text{Peter is } d\text{-tall})\)’, i.e. iff Maria is at least as tall as Peter.\(^\text{13}\)

\(^\text{13}\) Once again, spatial limitations force me to confine myself to the case of the equative as one exemplary illustration, here.
5 Predictions of the Phrasal Analysis for the Scopal Behaviour of the Comparative Operator and Quantified DPs

As a next step, I shall now take a closer look at what my phrasal approach to Turkish comparison constructions predicts for the scopal interaction of the comparative operator and quantified determiner phrases (DPs). To this end, I shall first consider (16), featuring a universally quantified DP in the standard term:

(16) Maria her oğlandan uzun.
    Maria every boy.Abl. tall
    ‘Maria is taller than every boy.’

Due to the fact that the Turkish comparison operator looks for two individuals (cf. (13) above), but finds only one individual and a quantified expression of semantic type $<<e,t>,t>$, instead, a type mismatch arises, which I suggest to remove by Quantifier-Raising (QR-ing) the string of words her oğlandan as indicated in the following logical form:

(17)
Observe now, that repairing the type mismatch in this fashion automatically predicts the quantified DP her oglandan to outscope the comparative operator and thus that (16) only comes out true iff Maria is even taller than the tallest among the boys (cf. the truth conditions given in (18a)), and that it won’t be considered true iff Maria is only taller than the shortest among the boys, which would correspond to the much weaker truth conditions (specified in (18b)), that would result from a logical form in which the comparative operator would have to take wide scope with respect to her oglandan.

\[
\begin{align*}
(18) \quad & a. \quad [[(16)]] = 1 \text{ iff } \forall x [\text{boy}(x) \rightarrow \max(\lambda d. \text{Maria is } d\text{-tall}) > \max(\lambda d. x \text{ is } d\text{-tall})] \\
& b. \quad [[(16)]] \neq 1 \text{ iff } \max(\lambda d. \text{Maria is } d\text{-tall}) > \max(\lambda d. \forall x [\text{boy}(x) \rightarrow x \text{ is } d\text{-tall}])
\end{align*}
\]

According to all my informants, the Turkish sentence (16) has – just as its corresponding English counterpart Mary is taller than every boy. – only the first of the two alternative readings outlined above, so that my phrasal analysis in combination with the requirement to resolve a type mismatch, which cannot even generate the unattested reading, immediately predicts the correct scopal order of the comparative operator and a universally quantified DP.\(^{14}\)

In a sentence containing an existentially quantified DP such as (19),

\[
\begin{align*}
(19) \quad & \text{Maria herhangi birinden uzun.} \\
& \text{María somebody.Abl. tall} \\
& \text{‘Maria is taller than some other person.’}
\end{align*}
\]

the emerging type mismatch would similarly be fixed by QR-ing herhangi birinden, which makes this quantified DP once again outscope the comparative operator and thus leads to the expectation that (19) should be considered true iff Maria is taller than some other person (cf. the truth conditions in (20a)), which is what sentence (19) actually means according to all my Turkish informants. And once again, the other reading with the reverse scopal order of the quantified DP herhangi birinden and the comparative operator, according to which (19) would come out true iff Maria is taller than everyone else is (cf. (20b)), is indeed unattested.

\[
\begin{align*}
(20) \quad & a. \quad [[(19)]] = 1 \text{ iff } \exists x [\text{person}(x) \& \max(\lambda d. \text{Maria is } d\text{-tall}) > \max(\lambda d. x \text{ is } d\text{-tall})] \\
& b. \quad [[(19)]] \neq 1 \text{ iff } \max(\lambda d. \text{Maria is } d\text{-tall}) > \max(\lambda d. \exists x [\text{person}(x) \& x \text{ is } d\text{-tall}])
\end{align*}
\]

Finally, it is worth noting that even the counterpart of the totally ungrammatical English (21) is perfectly acceptable in Turkish (22), and that it once more has the reading in which the quantified DP hiç kimseden outscopes the comparative operator, so that (22) is true iff Maria is (the) shortest (as specified in (23a)) and lacks the

alternative reading according to which (22) would have to be considered true iff Maria is simply not (the) tallest (cf. the truth conditions in (23b)), altogether.

(21) \* Mary is taller than nobody.

(22) Maria hiç kimseden uzun değil.

‘Mary is not taller than anybody.’; intended as: ‘Maria is taller than nobody.’

(23) a. \[[[(22)]] \] = 1 iff \( \exists x \ [\text{person}(x) \& \max(\lambda d. \text{Maria is } d\text{-tall}) > \max(\lambda d. x \text{ is } d\text{-tall})] \)

b. \[[[(22)]] \] \( \neq 1 \) iff \( \max(\lambda d. \text{Maria is } d\text{-tall}) > \max(\lambda d. \exists x \ [\text{person}(x) \& x \text{ is } d\text{-tall}]) \)

Additionally, one might consider cases with quantified DPs in the comparee, rather than the standard term, but given that the two potential readings are almost always indistinguishable in this case (cf. Heim (2001, pp. 217f.)), it does not really matter whether the quantified DP takes scope over the comparative operator, or whether the reverse situation obtains,\(^{15}\) so that although these data are perfectly compatible with the phrasal approach outlined above, they do not really constitute further evidence in favour of it.

6 A Word on the Cross-linguistic Distribution of Phrasal and Clausal Comparatives

Having established the need for a genuinely phrasal approach to comparatives in a language like Turkish, I shall now address the question of what the Turkish data makes us expect with respect to the distribution of phrasal and clausal comparatives cross-linguistically. On the basis of data largely taken from Hindi-Urdu, Bhatt & Takahashi (2007) argue that clausal comparatives constitute the ‘basic’ type that is taken to be universal and that phrasal comparatives exist only in certain languages. They reach this

\(^{15}\) To see this, take an English sentence like

(i) Every boy is taller than Mary.

that would be associated with the two truth conditions in (ii) depending on the scopal order of the quantified DP and the comparative operator:

(ii) a. \[\llbracket(i)\rrbracket = 1 \text{ iff } \forall x \ [\text{boy}(x) \rightarrow \max(\lambda d. x \text{ is } d\text{-tall}) > \max(\lambda d. \text{Mary is } d\text{-tall})] \]

b. \[\llbracket(i)\rrbracket = 1 \text{ iff } \max(\lambda d. \forall x \ [\text{boy}(x) \rightarrow x \text{ is } d\text{-tall})] > \max(\lambda d. \text{Mary is } d\text{-tall}) \]

In spite of their quite distinct surface appearance, (iia) and (iib) actually state exactly the same thing, for if the maximal degree to which every boy is tall is larger than that to which Mary is tall, it follows that even the shortest among the boys and thus every boy automatically happens to be taller than Mary.
conclusion (i) by following up on Lechner (2004), who has it that in languages like English and German, all comparatives are underlyingly clausal, and (ii) by observing that Hindi-Urdu displays phrasal comparatives paralleling the ones I found in Turkish alongside with correlative constructions that are undoubtedly clausal in nature. In contrast to this, I should like to defend the exactly opposite hypothesis: Since Turkish is much more radical than Hindi-Urdu in not even allowing correlatives, all Turkish comparatives clearly have a purely phrasal status and I thus seem to have come across a “language that has only individual comparison”, the existence of which was already stipulated in Kennedy (to appear, section 3.3). At the same time, I am absolutely convinced that even languages like English and German feature phrasal along with clausal comparatives, for which linguistic literature provides abundant evidence from syntax such as the (un-)availability of extraction operations (24) or that of reflexive pronouns bound by the matrix subject (25),

(24) a. *You finally met somebody you’re taller than.
   b. You finally met somebody you’re taller than is.  
   [Kennedy (1997, p. 163)]

(25) a. *No star is brighter than itself.
   b. No star is brighter than itself is.  
   [Kennedy (1997, p. 165)]

and empirical observations such as differences in meaning and/or acceptability between a phrasal comparative and its putative clausal source clearly point in this direction, too, as e.g. cases show where phrasal comparatives lack an obvious clausal counterpart (26), where the reverse situation obtains (27), or where the two sharply contrast in meaning (cf. the generic meaning of (28a) that disappears in (28b)):16

(26) a. John is older than me.
   b. *John is older than me am/is.  
   [Lechner (2004, p. 179)]

(27) a. *There couldn’t have been any more people than there were.
   b. There couldn’t have been any more people than there.  
   [Lechner (2004, p. 180)]

(28) a. He loved him more than a brother.
   b. He loved him more than he loved a brother.  
   [Heim (1985, p. 18)]

---
16 For additional evidence and detailed lines of argumentation defending the view that languages like English do indeed display both, clausal comparatives as well as truly phrasal ones that cannot be derived from underlying clausal sources, I refer the interested reader to Hankamer (1973), Hoeksema (1983), Napoli (1983), von Stechow (1984, section IX), Heim (1985, section 3.2) and Kennedy (1997, pp. 162-166; to appear, section 3.1).
Therefore, I rather assume phrasal comparatives to represent the ‘basic’ and potentially universal type of comparatives and that clausal ones are restricted to particular, English-like languages, instead.¹⁷

7 Conclusion and Outlook

In this paper, I have shown that Turkish comparatives never allow for a clausal standard term and thus cannot be analysed using the inherently clausal ‘standard’ English-like approach to comparatives, and that languages like Turkish require a truly phrasal account of comparison constructions, instead. I have developed such an analysis that successfully captures various sorts of Turkish comparison constructions and also makes the correct predictions with respect to the scopal behaviour of the comparative operator and quantified DPs, be these in the standard or in the comparee term. The radically phrasal status of Turkish comparatives furthermore led me to reject Bhatt & Takahashi (2007)’s assumption on the cross-linguistic distribution of phrasal and clausal comparatives and to hypothesise instead that it is the phrasal rather than the clausal type that constitutes the ‘basic’ comparison construction. And if my assumption that English features both, clausal as well as phrasal comparatives, is on the right track, the phrasal analysis could even be transferred to some English comparatives, where it might eventually solve a couple of long-standing problems such as differences in meaning between phrasal comparatives and their clausal counterparts or the fact that an English sentence like

(29) a. Mary is taller than every boy.

has only the reading where the quantified DP outscopes the comparative operator (cf. the truth conditions specified in (18a) above) and not the alternative one (cf. (18b)) with the reverse scopal order (Schwarzschild & Wilkinson (2002); Heim (2006, p.1)), which has hitherto remained unexplained, but follows neatly if I apply my phrasal analysis to this sentence, that cannot even generate the unattested alternative reading. The scope facts, however, seem to parallel those found in the corresponding clausal counterpart (29b).

(29) b. Mary is taller than every boy.

¹⁷ In Bhatt & Takahashi (to appear), the two authors altered their assumptions somewhat in that they now stipulate that both – phrasal and clausal comparatives – are available cross-linguistically and that it is rather the subcategorisational properties of the individual, language-specific comparative operators that account for their compatibility with phrasal and/or clausal complements. While it is largely unclear to me why phrasal and clausal comparatives should be taken to be universal if it is inherent properties of the specific operators that ultimately decide on their availability in a given language, I should still maintain that in my opinion, English than would have to subcategorise for phrasal as well as clausal complements under this approach, and not just for clausal ones only, and that Turkish would still differ from Hindi-Urdu in that, unlike its counterpart in the latter language, the Turkish comparative operator would have to subcategorise for phrasal comparatives, only.
A complete understanding of the English scope facts would therefore require an appropriate analysis of (29b) as well as a systematic way to decide on which English comparatives that display a phrasal surface structure are truly phrasal in nature, and which ones are just elliptical variants of a clausal source, which, however, remains yet to be investigated.

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Partial Semantics for Iterated if-Clauses

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Abstract
This paper argues in favor of a partial semantics for indicative conditionals, along the lines of a proposal made by Belnap in the seventies: conditionals only have a truth value if their antecedent is true, and in this case, their truth value equals the truth value of their consequent. I argue that this semantics offers a way out of the impasse following Gibbard’s (1981) famous proof that if \( \varphi \rightarrow (\psi \rightarrow \chi) \) and \( (\varphi \land \psi) \rightarrow \chi \) are equivalent, \( \rightarrow \) cannot be stronger than material implication.

1 Introduction

The present paper concerns the meaning of if in indicative conditionals. An example of such a conditional is (1):

(1) If it is snowing, it is cold.

I am going to explore a proposal made by Belnap (1970, 1973) which says that if corresponds to a two-place connective \( \rightarrow \), with a partial semantics, informally as follows:

(2) \( \varphi \rightarrow \psi \) only has a truth value if \( \varphi \) is true and if \( \varphi \rightarrow \psi \) has a truth value, this is the truth value of \( \psi \).

The structure of the paper is as follows. Section 2 introduces one of the problems that Belnap’s partial semantics helps to solve: the problem of iterated if-clauses. After that, section 3 discusses existing solutions and their problems. Then, in section 4 Belnap’s semantics is introduced and I will explain how it deals with iterated if-clauses.

Of course, once we adopt a partial semantics, we are bound to alter the predictions that classical approaches make about the logic of conditionals. But I will argue in section 5 that we shouldn’t be too worried about this. Finally, in 6 I will conclude the

\[\text{Footnote:} I \text{ actually believe that there are further reasons to adopt the partial semantics that I am championing here: (i) it offers a neat account of the interpretation of conditionals in the scope of quantifiers, and (ii) the interpersonal traffic of conditionals in dialogue seems to require a two-place connective just like the one I am advocating here. See Huitink (2008, chapter 5) for discussion.}\]
paper by some remarks on how the partiality that I propose to write into the semantics of *if* relates to the partiality that is often employed in theories of presupposition projection.

2 The problem: iterated *if*-clauses

2.1 Material implication and its paradoxes

In order to see what is problematic about iterated *if*-clauses, we must consider a traditional proposal about the meaning of *if*. Material implication goes back to Philo of Megara, but was championed by logicians like Frege and Russell. The idea is that an indicative conditional excludes the possibility that its antecedent is true while its consequent is false:

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<tr>
<th>ϕ</th>
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<th>ϕ ⊃ ψ</th>
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(3)

If you believe that *if* is truth functional, material implication is really the only reasonable option (in a classical system, that is). To see this, consider (4):

(4) If Mary and John are both in Paris, then Mary is in Paris.

This conditional is true, come what may. It is thus true when its components are (true, true), (false, true), or (false, false). Now, if conditionals are indeed truth-functional, it follows that they are always true in these cases, cf. Edgington (1995, 242).

Nevertheless, material implication seems plain wrong as an analysis of indicative conditionals. In fact, associating the semantics of ‘ordinary’ indicative conditionals with → leads to counterintuitive predictions, known as paradoxes of material implication (see Bennett (2003) for an overview). These paradoxes have two sources:

1. Whenever the antecedent is false, the conditional is true.
2. Whenever the consequent is true, the conditional is true.

The first paradox is that the material implication analysis predicts that the falsity of the antecedent is sufficient to affirm the truth of a conditional. However, this doesn’t seem to be borne out. We would not reason as follows: I am convinced that the Chinese will stay out of the conflict, therefore I am convinced that (5) is true (example from Stalnaker (1968)):

(5) If the Chinese enter into the Vietnam conflict, the United States will use nuclear weapons.

---

2 Obviously, the components of (4) are such that it cannot happen that the antecedent is true while the consequent is false. Hence, (4) does not establish that conditionals should be false in this case. However, no one doubts that conditionals are false in this situation.
The second paradox is that, given an analysis of indicative conditionals as material implications, the truth of the consequent is predicted to be sufficient to affirm the truth of a conditional. This, too, seems unwarranted. If you believe that the US will use nuclear weapons, simply because of their arrogance, the low intelligence of their president or whatever, but have no opinions about the future actions of the Chinese, you wouldn’t utter (5), which seems to state that there is some connection between the US warfare and Chinese politics. In sum, the problem with analyzing indicative conditionals as material implication is that this makes it far too easy for such conditionals to be true.

Several solutions have been proposed. Some have opted for a pragmatic defense, saying that conditionals with false antecedents (true consequents) are true, but infelicitous, e.g. David Lewis (1976), but it has convincingly been argued by Bennett (2003, 38-42) that such stories don’t hold water. In short, the problem is that disbelief in its antecedent does not automatically mean that one shouldn’t utter a conditional. Others have proposed stronger, modal truth conditions, i.e. strict implication by C.I. Lewis (1912, 1918). Conditionals do not just exclude that the antecedent is true while the consequent is false, but they claim that this is impossible. Such an analysis still gives rise to some paradoxes. For instance, if the antecedent is contradictory, the conditional is automatically true. Lewis thought that these paradoxes were less severe than those of material implication, but not everyone agreed (relevant logicians did not (Mares, 2008)).

2.2 Iterated if-clauses

We are now ready to state the problem about iterated if-clauses. The problem is that the following two sentences are equivalent. In fact, both are trivial (Edgington, 1995):

(6) a. If it rains or snows tomorrow, then if it doesn’t rain tomorrow, it will snow.
   b. If it rains or snows tomorrow and it doesn’t rain (tomorrow), it will snow.

Why is this problematic? This: Gibbard (1981) famously proved that it follows from this equivalence that indicative conditionals cannot have stronger truth conditions than material implication.

Let \( \rightarrow \) stand for the indicative conditional, without prejudging its semantics, and suppose we adopt the following principles:

(i) \( \varphi \rightarrow (\psi \rightarrow \chi) \equiv (\varphi \land \psi) \rightarrow \chi \)
(ii) \( \varphi \rightarrow \psi \models \varphi \supset \psi \)
(iii) If \( \varphi \models \psi \), then \( \models \varphi \rightarrow \psi \)

These principles appear unremarkable. The first of these is just the equivalence we want to account for. Principle (ii) says that whatever truth conditions we assign to \( \rightarrow \), they should be such that our conditional entails material implication. It seems agreed upon in the literature that we want this. Note that the modal analysis just alluded to (i.e. strict implication) makes it true. Finally, principle (iii) says that if one sentence entails another, it implies this sentence. For example, ‘Mary and John are both in Paris’ entails ‘Mary is in Paris’, and ‘If Mary and John are both in Paris, then Mary is in Paris’ is indeed tautological.
Yet given these principles, we can proof that indicative conditionals cannot be stronger than material implication. The proof proceeds by showing that (7) is a tautology and that it entails (8):

(7) \((\varphi \supset \psi) \rightarrow (\varphi \rightarrow \psi)\)
(8) \((\varphi \supset \psi) \supset (\varphi \rightarrow \psi)\).

To see that (7) is a tautology, note that it is by (i) equivalent to \(((\varphi \supset \psi) \land \varphi) \rightarrow \psi\). This, in turn, is equivalent to \((\varphi \land \psi) \rightarrow \psi\) (by proposition logic). By (iii), this formula is true in any world. Now, given that \(\rightarrow\) entails \(\supset\) (principle (ii)) (7) entails (8). Now, as (8) is entailed by a tautology, (8) must itself be a tautology, and this must be because its antecedent entails its consequent. It follows that \(\rightarrow\) cannot have stronger truth conditions than \(\supset\).

3 Previous solutions

3.1 Kratzer’s solution

Let’s now discuss some solutions in the literature. First, Kratzer (1991) argues that Gibbard’s proof shows that we were mistaken to assume that such things as conditional connectives exist. She wrote that:

The history of the conditional is the story of a syntactic mistake. There is no two-place if . . . then connective in the logical forms of natural languages. If-clauses are devices for restricting the domains of various operators. Whenever there is no explicit operator, we have to posit one. (Kratzer, 1991, 656)

Take (9), in which a conditional occurs in the scope of a modal:

(9) If it is snowing, it must be cold.

Intuitively, the if-clause provides the restrictor of the modal, i.e. quantification ranges over worlds in which it is snowing. This follows if the modal and the if-clause are interpreted as a single quantifier-restrictor complex.

(10) (must if it is snowing) (it is cold)
    “in all accessible worlds where it is snowing, it is cold”

Of course, not all conditionals occur embedded under an overt quantificational operator, but Kratzer assumes that in these cases, we must postulate a covert operator, which is usually an epistemic necessity modal like must. So (11) is analyzed as equivalent to (9), which seems right:

(11) If it is snowing, it is cold.
    \(\approx\) If it is snowing, it must be cold
    “in all accessible worlds where it is snowing, it is cold”
We can now see how Krater would analyze iterated *if*-clauses. She proposes to treat such *if*-clauses as stacked relative clauses, which results in successive restriction of the domain:

(12) If it rains or snows tomorrow, then if it doesn’t rain tomorrow, it will snow.

   “in all worlds in which it rains or snows tomorrow and in which it doesn’t rain tomorrow, it will snow”

Though this gets the predictions right, it requires to drastically rearrange various parts of the sentence (at surface, the *if*-clause occurs sentence-initially, far away from the covert operator that it is supposed to restrict).

   Particularly problematic is the position of *then*. Intuitively, this word is some anaphoric element which picks up the *if*-clause (in von Fintel’s (1994, chapter 3) version of the analysis, *then* is a phonetic realization of the modal’s restrictor variable). However, then it occurs in the wrong place. Compare:

(13) a. If it rains or snows tomorrow, *then* if it doesn’t rain tomorrow, it will snow.
    b. If it rains or snows tomorrow, if it doesn’t rain tomorrow, *then* it will snow.

We want to account for the meaning of (13a), but on Kratzer’s analysis one would expect that this meaning could only be expressed by (13b).

### 3.2 Schlenker’s solution

To solve the syntax-semantics mismatch associated with Kratzer’s analysis, Schlenker (2004) proposes that *if*-clauses are plural definite descriptions of possible worlds. He would analyze our sentence as follows:

(14) If it rains or snows tomorrow, then if it doesn’t rain tomorrow, it will snow.

    [\[tW: \text{it rains or snows tomorrow (W)}]\[tW': W' \subseteq W \text{ and it doesn’t rain tomorrow (W')}][\[all w: w \in W'] \text{ (it will snow (w))}]

Thus, Schlenker takes over Kratzer’s assumption that the sentence contains a covert quantifier over possible worlds, but the relevant domain is now determined in a different way. The first *if*-clause denotes all and only those worlds in which it rains or snows. The second *if*-clause narrows this further down to just those worlds in which it rains or snows but doesn’t rain. It is asserted that in all of the remaining worlds it snows.  

Crucially, the (covert) modal in (14) is interpreted *in situ*. Hence, this representation is more natural than Kratzer’s analysis from a syntactic point of view. However, the analysis makes different predictions than Kratzer does. For instance, it is now expected

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3This analysis goes back to Schein (2003), who proposed it to solve a puzzle raised by Barker (1997): if pronouns go proxy for definite descriptions (as the E-type approach has it), how to account for sentences like (i)?

(i) If a theory is classical, then if it is inconsistent, it is usually trivial.

Here, the second occurrence of *it* is to be analyzed as ‘the classical inconsistent theory’, but this interpretation cannot be derived if *usually* is restricted by the coordination of the *if*-clauses.
that modals can also collectively quantify over the worlds supplied by the if-clause. But, as far as I know, such cases have not been attested.

4 Belnap’s partial semantics

4.1 Conditional assertion

Belnap (1970, 1973) presents his conditional semantics as a formalization of the idea that conditionals make conditional assertions. He traces this idea back to Quine:

Now under what circumstances is a conditional true? Even to raise this question is to depart from everyday attitudes. An affirmation of the form ‘if \( p \) then \( q \)’ is commonly felt less as an affirmation of a conditional than as a conditional affirmation of the consequent. [At this point, Quine credits Dr. Philip Rhinelander in a footnote - JH] If, after we have made such an affirmation, the antecedent turns out true, then we consider ourselves committed to the consequent, and are ready to acknowledge error if it proves false. If on the other hand the antecedent turns out to have been false, our conditional affirmation is as if it had never been made. (Quine, 1950, 12)

To see the point, consider (15), which is taken from McDermott (1996) and concerns the result of the next roll of an ordinary, six-sided dice:

(15) If it is even, it will be a six.

Suppose that you had bet on (15). It seems clear that the bet is won when the result of the next roll is six, and lost when the result is four. But what if it is five? McDermott reports that most people assume that the bet is called off in this case.

Belnap wanted to give a semantic version of conditional assertion. He originally proposed the following in Belnap (1970) (still somewhat vague; to be made precise below):

(16) If \( \varphi \) is true in \( w \), then what \( \varphi \to \psi \) asserts in \( w \) is what \( \psi \) asserts in \( w \). If \( \varphi \) is false or nonassertive in \( w \), then \( \varphi \to \psi \) is nonassertive in \( w \).

But this doesn’t allow for iterating if-clauses. Therefore in Belnap (1973) he added the restriction that the scope should be assertive:

(17) If \( \varphi \) is true in \( w \) and \( \psi \) is assertive in \( w \), then what \( \varphi \to \psi \) asserts in \( w \) is what \( \psi \) asserts in \( w \). If \( \varphi \) is false or nonassertive in \( w \) or if \( \psi \) is nonassertive in \( w \), then \( \varphi \to \psi \) is nonassertive in \( w \).

Now, the phrase ‘what \( \varphi \to \psi \) asserts in \( w \) is what \( \psi \) asserts in \( w \)’ can be understood in two ways. It could be that \( \varphi \to \psi \) has the truth value of its consequent, or it could be that it expresses the same proposition. Then \( w \) is a part of the context rather than an index of evaluation. Belnap chose this second option. He reckoned the first option was rather boring, writing that what \( \varphi \to \psi \) asserts in \( w \) is identical to what \( \psi \) asserts in \( w \) “does
not boringly mean an identity of truth-values but an identity of propositional content’ (Belnap, 1970, 4).

However, I think that the interesting semantics is not at all what we want for conditionals. To see the problem, consider the following example by Edgington (1995, 289):

(18) If you press that switch, there will be an explosion.

Clearly, my saying (18) might well save your life, especially when the antecedent is false. But how is this possible if (18) fails to assert a proposition? How can (18) ever be used to persuade you to not press that switch, if my utterance of it fails to communicate something for you to grasp? 

So I define conditional assertion as follows:

(19) \( \varphi \rightarrow \psi \) is defined in a world \( w \) if \( \varphi \) is true in \( w \) and \( \psi \) is defined in \( w \)

If defined, the truth value of \( \varphi \rightarrow \psi \) in \( w \) is the same as the truth value of \( \psi \) in \( w \)

Notice incidentally that (18) also suggests that we should change the norm for assertion. Classically, one should only assert something if one knows/beliefs (depending on your favorite theory of assertion) that it is true. But then (18) couldn’t felicitously be asserted, as it probably has no truth value. In our partial system, however, the norm for asserting a proposition should be the knowledge/belief that it is true, given that it has a truth value, cf. McDermott (1996).

Belnap championed this semantics because he wanted to give a uniform analysis of every crow and some crow as ‘for every \( x \), if \( x \) is a crow’ and ‘for some \( x \), if \( x \) is a crow’, respectively. (Recall that classically, the domain of a universal quantifier is restricted by a conditional, but for existential quantifiers a conjunction is used.)

(20) a. Every crow is black.
   for every \( x \), if \( x \) is a crow, \( x \) is black
b. Some crow is black.
   for some \( x \), if \( x \) is a crow, \( x \) is black

If quantifiers care only about cases for which their scope is defined, this works: “for some \( x \) for which ‘if \( x \) is a crow, \( x \) is black’ is defined, i.e. for some \( x \) which is a crow, it is true that \( x \) is black”. However, for ordinary restricted quantification, as supplied by common nouns, this is unattractive. First, no one believes that quantifiers are unary operators. Second, this involves postulating an inaudible if. Although I don’t think Belnap’s semantics should be employed in a uniform analysis of (20a) and (20b), I do believe that it provides a solution to the problem of iterated if-clauses, which I will argue for next.

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4Note that the last statement of Quine’s quote is thus plain false.
4.2 Solving Gibbard’s problem

We can now analyze our sentence as follows:

(21) If it rains or snows tomorrow, then if it doesn’t rain tomorrow, it will snow.
    (it rains or snows tomorrow) → (it doesn’t rain tomorrow → it will snow)

If (21) has a truth value, i.e. if it rains or snows, and if the embedded conditional has a truth value, i.e. if it doesn’t rain, it snows. That is, it snows if it rains or snows but doesn’t rain. So (21) comes out equivalent to (22):

(22) If it rains or snows tomorrow and it doesn’t rain tomorrow, then it will snow.

Note that on this theory, there is no mismatch between syntax and semantics, as this representation mirrors the surface form of (21). Of course, on this semantics, neither of these sentences comes out as trivial, because they may be undefined (the antecedent may not be true). However, they do come out trivial on the assumption that the sentences have a truth value. Clearly, if they have a truth value, this value is most definitely true. Below in section 5, I will argue that our every-day judgments of validity and triviality are guided by the assumption that the statements involved are defined. That is, I will propose to combine Belnap’s semantics with what is known as Strawson-entailment (von Fintel, 1999).

Summing up, there is another way to avoid the conclusion that if we want to have the equivalence between (6a) and (6b), material implication is the only candidate for indicative conditionals. We can assign partial truth conditions to indicative conditionals. This suggests that Gibbard’s proof only holds in a classical, two-valued system. Indeed, in a partial system, it is plain that Gibbard’s principles do not straightforwardly hold. The problem is his third principle, repeated here:

(iii) If φ |= ψ, then |= φ → ψ

Given Belnap’s semantics, this is simply not true. If all worlds that make φ true are worlds that make ψ true, it doesn’t follow that all worlds make φ → ψ true, for some worlds are ¬φ-worlds and in these worlds, φ → ψ has no truth value.

5 Logical implications

By adopting a partial semantics for if, we loose the validity of certain laws which “warm the cockles of a logician’s heart”, as (Belnap, 1973, 51) nicely puts it. Indeed, Lycan (2006) sees this this as the main objection against conditional assertion theories. In Belnap’s semantics, the following do no longer hold:5

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5It is very likely that even more laws do no longer hold. We restrict attention to Contraposition and Or-to-if-inference, because the invalidity of these particular two is often used as an argument against conditional assertion theories, see for instance Lycan (2006).
(23) a. Contraposition:
\[ \varphi \rightarrow \psi \equiv \neg \psi \rightarrow \neg \varphi \]
b. Or-to-if-inference:
\[ \varphi \lor \psi \models \neg \varphi \rightarrow \psi \]

Any world in which \( \varphi \rightarrow \psi \) is true, is a world in which \( \psi \) is true, and therefore a world in which \( \neg \psi \rightarrow \neg \varphi \) lacks a truth value. It is easy to see that the reverse direction doesn’t hold either. Contraposition is thus ruled out. As for Or-to-if-inference, some worlds in which \( \varphi \lor \psi \) is true will make \( \varphi \) is true. These worlds will clearly not make \( \neg \varphi \rightarrow \psi \) true.\(^6\)

This is a problem, for Contraposition and Or-to-if-inference do seem to hold for natural language indicative conditionals, as (24) and (25) respectively show:

(24) If it is raining, we won’t play.
    Therefore, if we play, it isn’t raining.
(25) Either Oswald killed Kennedy, or someone else did.
    Therefore, if Oswald didn’t kill Kennedy, someone else did.

But if Contraposition and Or-to-if-inference are not valid, then why are (24) and (25) such compelling arguments? I submit that our judgments about the validity of (24) and (25) come about by the tacit assumption that the premise and conclusion have a truth value.

Strawson (1952) considers ways to make the inference from the Aristotelean A-form to the Aristotelean I-form valid:

(26) Every crow is black.
    Therefore, some crows are black.

Traditionally, the inference in (26) is not justified, for its premise is true in models in which there are no crows, yet its conclusion is clearly false in such a model. However, most English speakers find (26) valid.

Strawson sought to solve this puzzle by (i) abandoning the assumption that all sentences necessarily have a truth value, and (ii) redefining the notion of entailment. He assumes that A-forms are neither true nor false in case their subject term is empty. In addition, Strawson assumes that cases in which the subject term is empty are irrelevant as far as entailment is concerned:

The rule that A entails I states that, if corresponding statements of these forms have truth values, then if the statement of the A form is true, the statement of the I form must be true; and so on. (Strawson, 1952, 177)

\(^6\)The reverse direction ‘If-to-or-inference’ of course does come out: any world in which \( \neg \varphi \rightarrow \psi \) is true, is a world in which \( \varphi \lor \psi \) is true in all worlds.

\(^7\)All I am presuming here about the meaning of \( \neg \) and \( \lor \) is that \( \neg \psi \) is not true if \( \psi \) is, and that \( \varphi \lor \psi \) is true if \( \varphi \) is. I consider this uncontroversial. Yet the reader may wonder about the semantics of connectives other than \( \rightarrow \), now that we are working in a partial system. The semantics that Belnap assumes comes down to strong Kleene, except of course his definitions for \( \rightarrow \).
Let $\models_S$ be the kind of entailment that Strawson had in mind. This can be defined as follows:

$$\phi \models_S \psi \text{ iff } \phi, \chi \models_S \psi \text{ (i.e. } \phi, \chi \text{ classically entails } \psi \text{) }$$

where $\chi$ is a premise stating that the definedness conditions of all statements involved are satisfied.

It is easy to see that (26) is Strawson-valid. The premise presupposes that there are crows. Strawson thought of this as a precondition for the premise to have a truth value: only if there are crows, can ‘Every crow is black’ be true or false. It follows that provided that the premise of (26) has a truth value, we are justified to conclude that some crows are black.

Belnap (1973) himself refers to this notion of entailment as a useful one for conditional assertion. Indeed, both Or-to-if-inference and Contraposition turn out to be Strawson-valid:

(27) a. Contraposition:
$$\phi \rightarrow \psi \equiv_S -\psi \rightarrow -\phi$$
b. Or-to-if-inference:
$$\phi \lor \psi \models_S -\phi \rightarrow \psi$$

Contraposition follows, i.e. $\phi \rightarrow \psi, -\psi \models_S -\psi \rightarrow -\phi$ because there is no world which makes $\phi \rightarrow \psi$ and $-\psi$ true. The same holds for the other direction. Clearly, Or-to-if-inference is also Strawson-valid: any worlds in which $\phi \lor \psi$ is true and in which $-\phi \rightarrow \psi$ has a truth value, is a world in which $-\phi \rightarrow \psi$ is true. Thus, assuming that the statements are either true or false, we get the inferences we want.

What does this mean for our inferences in (24) and (25)? In as far as these are valid, they are enthymematic inferences, i.e. inferences that rely on an additional tacit premise: that the statements involved have a (classical) truth value. It could well be that Strawson-entailment describes the way that human reasoning naturally works. Moreover, it seems that other linguistic phenomena are also sensitive to Strawson-entailment: von Fintel (1999) argues that NPI licensing is sensitive to Strawson-downward entailment:

von Fintel (1999) argues that NPI licensing is sensitive to Strawson-downward entailment.

Note that it also follows that (28a) and (28b) are Strawson-valid (they are Strawson-entailed by any tautology):

(28) a. If it rains or snows tomorrow, then if it doesn’t rain tomorrow, it will snow.
b. If it rains or snows tomorrow and it doesn’t rain tomorrow, then it will snow.

If our intuitions are indeed guided by Strawson-entailment, it is thus explained why these sentences, even though they are strictly speaking not tautologies, nevertheless seem trivial.
6 Relation to presupposition

Truth value gaps have often been used to model presuppositions, but the partiality we have written into the semantics of if must obviously be distinguished from presupposition. This was already observed by Belnap: 8

Suppose we say that A S-"presupposes" B if whenever A is assertive, B is true. This is, I take it, a semantic rendering in the present context of Strawsonian presupposition, for then to say that A S-"presupposes" B is to say that the truth of B is a necessary condition for the assertiveness of A. But then it turns out for categorial A that (A/B) S-"presupposes" A, for the truth of the antecedent, A, is a necessary condition for the assertiveness of the conditional, (A/B), and indeed is the paradigm case of such. But it would be mad to suggest that "If Sam is a crow, then Sam is black" presupposes "Sam is a crow", a madness which accounts for the shudder quotes in 'S-"presupposes"'. For A to presuppose B in the pragmatic sense, it should be the case that one who utters A somehow commits himself to the truth of B. It should be that he has done something pragmatically unacceptable if he utters A when B is false. Something like this surely obtains when one utters "The present king of France is bald". But of course the whole point of conditional assertion is to be able to avoid any commitment whatsoever when the antecedent turns out false. Thus, although definable, S-"presupposition" should not be taken as a semantic analogue of pragmatic presupposition. (Belnap, 1973, 70)

Someone who utters ‘All John’s children are bald’ in case John has no children, counts as having misled her audience. But this does not hold for a speaker who uttered a conditional with a false antecedent. In fact, if conditionals presupposed their antecedent, one would expect that natural language didn’t contain any conditionals. On Gricean assumptions, if it were given that John has children, one shouldn’t say ‘If John has children, they are bald’, but just ‘His children are bald’. 9

Perhaps we should assume that the presupposition of conditionals is of the kind that is never already given, but that always has to be accommodated? This won’t work. Following Gazdar (1979), it is usually assumed that conditionals ‘If ϕ, ψ’ give rise to the clausal implicatures ♦ϕ and ♦¬ϕ, and that if a presupposition clashes with a clausal implicature, the implicature ‘wins’, i.e. the presupposition is canceled. It follows that if conditionals presupposed their antecedent, this presupposition would automatically be canceled. 10 To sum up, Belnap-partiality must be concluded to have nothing to do with presupposition. 11

8Note that Belnap uses the slash / as his conditional connective, whereas I use the arrow →.
9Ordinarily, that is. In some situations, for instance in an argument via modus ponens it is allowed to assert a conditional whose antecedent is already given.
10See also Stalnaker (1975) and van der Sandt (1988), though these authors do not work in Gazdar’s framework. For instance, in van der Sandt’s system, the presupposition is canceled because it clashes with the fact that the conditional was uttered. Of course, the underlying intuition is similar to Gazdar’s.
11Soames (1989) distinguishes so-called ‘expressive presuppositions’: 
Given some presupposition theories, this is problematic. For instance, Heim’s (1983) context change potentials are essentially based on a partial semantics. If we were to combine this theory with our Belnap-semantics, we would thus be assuming two distinct kinds of partiality. But this seems impossible in as far as undefinedness comes down to a lack of semantic value; how can we distinguish between two non-existing values? On the other hand, other presupposition theories, most notably the anaphoric binding theory of van der Sandt (1992); Geurts (1999), are fully independent of truth value gaps. Adopting Belnap’s semantics thus does not automatically commit us to there being different kinds of undefinedness. At any rate, it is clear that Belnap-gaps just are not presupposition-gaps.\(^\text{12}\)

7 Conclusion

In this paper I have argued in favor of a new way to avoid Gibbard’s conclusion that the meaning of iterated if-clauses implies that the semantics of if cannot be stronger than material implication. The solution is to assign a partial semantics to indicative conditionals: a conditional only has a truth value in case its antecedent is true. And if the antecedent is true, the truth value of the entire conditional is the truth value of the consequent. I have argued that this semantics can be made to yield a plausible logic for conditionals, and I have explained why Belnap-partiality should be distinguished from the partiality that is often associated with presupposition failure.

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References


(i) Sentence S expressively presupposes proposition A relative to a context of utterance C iff the truth of A is necessary for S to semantically express a proposition in C.

So perhaps, had we opted for the less boring version of Belnap’s semantics, we would have been able to link Belnap-partiality to (a very specific kind of) presupposition. But of course, we have good reason not to have opted for this semantics.

\(^{12}\) Note that the difference between presupposition and conditional assertion just alluded to provides another reason why we shouldn’t recruit Belnap’s semantics for all kinds of domain restriction. Quantifiers are normally felt to presuppose their domain (Strawson, 1952; Geurts & van der Sandt, 1999), precisely because uttering “Every crow is black” in case there are no crows is misleading. But analyzing this sentence in terms of $\rightarrow$ would suggest that it is felicitous if there are no crows.


Abstract
Bridging anaphora can refer not only to previously introduced discourse entities, but also to abstract entities such as eventualities. The proposal made in this paper is to extend the current account of bridging in SDRT in a way that implicit reference to eventualities can be accounted for. We exploit the idea developed in Frame Semantics that world knowledge is organized in frames. With each eventuality introduced in a discourse, a corresponding frame is evoked in the discourse model. SDRT will be extended to include possibly underspecified representations of frame elements, which can give clues for finding suitable antecedents in bridging anaphora.

1 Introduction
Natural language discourses consisting of several utterances are more than merely stringing the utterances together. Discourses are structured and there are relationships between utterances at various levels. Basically, one can distinguish coherence and cohesion in a discourse. On the one hand, text segments are connected by discourse relations, yielding coherence of a discourse. On the other hand, there are many anaphoric relations within a single utterance as well as spanning bigger distances. They are responsible for cohesion in a text. Various types of anaphora can be distinguished - they can be either direct, e.g. if a pronoun is used, or more indirect, if there is some connection but no direct coreference between discourse entities. Clark (1977) called these cases of anaphora bridging anaphora. In a bridging anaphor, an entity introduced in a discourse stands in a particular relation to some previously mentioned discourse entity. This bridging relation is not explicitly stated. Yet it is an essential part of the discourse content because the knowledge of these relations is necessary for successfully interpreting a discourse.

Clark differentiated various kinds of bridging inferences. The most prominent type is indirect reference by association, where the antecedent is closely associated with a discourse entity mentioned before. There is some literature concerning these cases (cf. Asher and Lascarides, 1998a; Piwek and Krahmer, 2000). Another type of bridging is indirect reference by characterization, where the bridging relation characterizes a role that
something implicitly plays in an eventuality\(^1\) mentioned before. Roles can be optional or necessary agents, objects, or instruments. Less work is done on this topic. Koenig and Mauner (1999) deal with reference to thematic arguments, and Bos et al. (1995) propose a lexical account for bridging. In this paper, we want to investigate how extralinguistic information sources constrain bridging references to eventualities. We will take Clark’s example (1) as a prototypical case.

(1) a. John was murdered yesterday.
   b. The knife lay nearby.

Utterance (1-a) describes a killing event which took place on the day preceding the utterance. The individual referred to by the proper name “John” is the victim of the event. Utterance (1-b) describes a state of the entity denoted by the definite noun phrase “the knife”\(^2\). This entity is new in the discourse, but stands in an implicit relation to the event described in utterance (1-a): the knife served probably as the instrument of the killing event. This relationship is not expressed by linguistic means. Instead, the hearer has to infer it using contextual knowledge. Apart from understanding the previous utterance, successful interpretation of (1-b) requires some world knowledge: in a murdering event, there must be a victim and a killer, and normally there is also an instrument used for performing the act.

Only by means of this additional knowledge, the hearer can successfully interpret the utterance and connect it to the preceding discourse. In this way, interpretation involves incrementally constructing a structured mental representation of the discourse. It is structured in the sense that rhetorical relations hold between discourse segments. In example (1), utterance (b) is subordinated to (a), providing background information. Neither these relations between utterances nor relations between discourse entities (including eventualities) have necessarily to be expressed directly by linguistic means. They often exist only implicitly, forcing the hearer to infer them using defeasible pragmatic inferences. In a successful interpretation, all information, not only directly expressed but also indirectly inferred, will be part of the discourse model constructed by the hearer in course of interpretation. The discourse model, as Cornish (1999) puts it, is “a constantly evolving representation of the entities, propositions, eventualities, properties, and states, as well as their interrelations, which are introduced into the discourse, or are assumed already to exist therein, at particular points”. We adopt Segmented Discourse Representation Theory (SDRT, Asher and Lascarides, 2003) as theory of modelling discourse structure and processes, a theory that has already been formalized in considerable detail.

The remainder of this paper is organized as follows. In section 2, we will summarize the current account of bridging in the framework of SDRT and introduce the basic

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\(^1\)We use the term *eventuality* for uniformly referring to events, states, actions or circumstances.

\(^2\)There are also cases of referring indefinite noun phrases which convey a bridging relation. In (i), “a knife” clearly refers to the probable instrument of murdering, almost identically as in example (1).

(i) John was murdered yesterday. A knife lay nearby.

As the literature on bridging mainly focuses on definite descriptions, we will concentrate on utterances involving definites. Different behaviour of indefinites is indicated whenever necessary.
ideas of Frame Semantics before we propose to integrate these two lines of research. Section 3 shows how bridging references can be solved using the proposed account. In section 4, we discuss related approaches, and we conclude in section 5.

2 Using Frame Semantics for Bridging in SDRT

2.1 Bridging in SDRT

We assume that the hearer is familiar with the basics of dynamic semantics (DRT, Kamp and Reyle, 1993). SDRT (Asher and Lascarides, 2003) is an extension of DRT with basically two new expressions: (i) speech act discourse referents, which label content of text segments and keep track of token utterances, and (ii) rhetorical relations, which relate speech act discourse referents. The resulting structures are segmented DRSs (SDRSs).

In SDRT, bridging inferences are seen as “a byproduct of computing how the current sentence connects to the previous ones in the discourse” (Asher and Lascarides, 1998a). Four meta-rules for bridging are stated:

1. If possible use identity.
2. Bridges must be plausible.
3. Discourse structure determines bridging.
4. Maximize discourse coherence.

The first rule reflects the empirical preference of resolving anaphora to an identical antecedent. This rule is the preferred rule; if resolution to identity is not possible, then the other rules apply in the indicated order. The second rule means that world knowledge “specifies certain plausible ways of filling the underspecified parameters in the presupposed material”. Thus, plausibility relies on world knowledge, but is not precisely defined. We will try to refine this notion in a more constrained way. The third rule states that if a rhetorical relation between the involved discourse segments gives particular clues for resolving the anaphora, then this information is to be used. The fourth rule is one of the most basic principles assumed in SDRT. In discourse interpretation, there is a preference for resolving bridging anaphora in a way that maximizes discourse coherence.

To see more formally how bridging inferences are drawn in SDRT, we will concentrate on the meaning representation of definite descriptions triggering bridging inferences. In Russianellian tradition, the denotation of a definite noun phrase can only be given if it fulfills the conditions on existence and uniqueness. This can be written in a short form using the iota operator $\iota$ which maps a set containing only one element to this element. An expression $\iota x. P(x)$, representing the core meaning of “the $P$”, denotes $x$ if $\exists x. P(x) \land \forall x' [P(x') \rightarrow x' = x]$ is true; if not, it is not defined. Chierchia (1995, p. 221) extends this notion and includes a contextual parameter $B$ for a bridging relation. He claims that “the $P$” denotes a $P$ that is related by $B$ to an antecedent $a$ to be specified by context. $B$ restricts the domain and must be included in the uniqueness condition.
Building on that, Asher and Lascarides (1998a, p. 87) characterize the meaning of a definite noun phrase as $\lambda Q . Q(\text{tx}(B(x,a) \land P(x)))$. This expression applies a predicate $Q$ (the verb meaning) to the entity $x$, for which $P$ (the meaning of the NP) is true and that is related by a bridging relation $B$ to some contextually given antecedent $a$.

This meaning characterization corresponds to the SDRT representation shown in (2). Note that the condition of uniqueness is now represented by the DRS condition consisting of the two small DRSs connected by $\Rightarrow$. The representation of an indefinite noun phrase would be very similar, in the sense that we just leave out the uniqueness condition and keep the rest of the conditions.

There are two underspecifications to be specified by pragmatic inference: Firstly, a coherence relation $R(u, v)$ has to be established. According to Asher and Lascarides (1998b), a definite description triggers a coherence relation between the current utterance $u$ and some previous utterance $v$. Secondly, in the bridging relation $B(a, x)$, the parameters $B$ and $a$ have to be specified (Asher and Lascarides, 1998a). For direct anaphora, $B$ is identity. For indirect reference by association, $B$ can be part-of or member-of. For indirect reference by characterization, $B$ is a thematic role, e.g., agent, theme, or instrument. The question we want to go further into is what kind of information can we exploit to help us drawing these inferences.

### 2.2 Frame Semantics and FrameNet

To get clues for the resolution of this kind of bridging inferences, we propose to exploit an idea already mentioned in Gardent et al. (2003), but not further pursued. The idea is to use Frame Semantics, developed by Fillmore (1976), and subsequent work on FrameNet (Baker et al., 1998; Fillmore et al., 2003). This framework is based on the central assumption that world knowledge is organized in frames. Basic units are frames and lexical units. Frames are mental representations of stereotypical situations, whose elements can only be defined by relating one to another. A lexical unit is a pairing of a word with a meaning; polysemous words are represented by several lexical units. Every lexical unit evokes a particular frame and can only be understood in relation to that frame.

FrameNet (Baker et al., 1998) is a lexical resource providing a body of annotated sentences based on frame semantics. The database contains around 10,000 lexical units, 800 semantic frames and over 120,000 example sentences. Frames are hierarchically organized: e.g., the frame Killing inherits the properties from the more general frame Transitive action, which in turn inherits from the abstract frame Event. A frame con-
sists of various **Frame Elements**, kinds of entities that can participate in a frame. They are defined in relation to a frame, and correspond roughly to thematic roles in an event. Sometimes, conceptually necessary Frame Elements do not show up in a sentence. This is the case of omitted agents in passive sentences (Constructional Null Instantiation, CNI), missing obligatory elements that can be inferred from the context (Definite Null Instantiation, DNI), or implicit arguments of certain transitive verbs that are used intransitively, e.g. verbs as *eat*, *bake* (Indefinite Null Instantiation, INI). For illustration, the *Killing* frame is described below in Fig. 1, and one of the lexical units evoking that frame, the verb *murder*, is characterized in Fig. 2.⁴

**Definition:** A Killer or Cause causes the death of the Victim.

**Core Frame Elements**:

<table>
<thead>
<tr>
<th>FE</th>
<th>description</th>
<th>inherited FE</th>
<th>semantic type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Killer</td>
<td>The person or sentient entity that causes the death of the Victim</td>
<td>Agent</td>
<td>sentient</td>
</tr>
<tr>
<td>Victim</td>
<td>The living entity that dies as a result of the killing</td>
<td>Patient</td>
<td>sentient</td>
</tr>
<tr>
<td>Instrument</td>
<td>The device used by the Killer to bring about the death of the Victim</td>
<td>Instr.</td>
<td>physical entity</td>
</tr>
<tr>
<td>Cause</td>
<td>An inanimate entity or process that causes the death of the Victim</td>
<td>Cause</td>
<td></td>
</tr>
<tr>
<td>Means</td>
<td>The method or action that the Killer or Cause performs resulting in the death of the Victim</td>
<td>Means</td>
<td>state of affairs</td>
</tr>
</tbody>
</table>

**Non-Core Frame Elements:** Beneficiary, Manner, Place, Purpose, Time, ...

**Lexical Units:** annihilate.v, annihilation.n, ..., murder.n, murder.v, murderer.n, ..., terminate.v

---

**Figure 1: The Killing frame**

As can be seen in Fig. 2, there are three cases among the 23 annotated sentences in the FrameNet database containing the lexical unit *murder.v* in which the Killer was not expressed at all (CNI), and the Victim showed up as external argument of the verb. This configuration is typical for passive sentences like (1).

An important question is whether a linguistic expression denoting an eventuality, e.g. a verb, evokes at most one frame, exactly one frame, or more than one frame⁴. As said above, in FrameNet, a *lexical unit* is defined as a pairing of a word with a sense. For a polysemous word, “the separate senses of the word correspond to the different (sets of) frames that the word can participate in. When a word’s sense is based on a

---

⁴Definitions are taken from the FrameNet Database, obtainable from the International Computer Science Institute, Berkeley, California (http://framenet.icsi.berkeley.edu/).

⁴I owe the examples to an anonymous reviewer who drew my attention to this point.
Lexical Entry: murder.v

- Frame elements and their syntactic realizations

  Killer | CNI.– (3), NP.Ext (15), PP[by].Dep (5)
  Victim | NP.Ext (8), INI.– (1), NP:Obj(14)

- Frame elements and valence patterns

<table>
<thead>
<tr>
<th>frame element</th>
<th>realized as</th>
</tr>
</thead>
<tbody>
<tr>
<td>Killer</td>
<td>NP:Ext</td>
</tr>
<tr>
<td>Victim</td>
<td>NP:Obj</td>
</tr>
<tr>
<td>(23)</td>
<td>(14)</td>
</tr>
</tbody>
</table>

Figure 2: Lexical entry murder.v

particular frame, the word evokes the frame” (Fillmore et al., 2003). For example, the verb “break” can evoke, among others, the frame Experience_bodily_harm (e.g. in “I broke my leg”) or the frame Render_nonfunctional (in “I guess I broke the doorknob”). Thus, interpretation of a text requires assumptions about which frame is relevant in the given context. Take the verb “eat”: it could be associated with a set of frames, e.g. a restaurant frame, a family home frame, a wild-animals-in-the-open frame, etc. The question is how the right frame ends up being selected. We would suggest to choose the most general frame fitting in the given context. For “eating” this would be the frame Ingestion. Due to the hierarchical structure of FrameNet, any frame involving eating would inherit the properties and frame elements of this frame. Of course, in case that there are various very divergent senses of a word, the selected frame perhaps is too general to be helpful for our purposes. But still, FrameNet provides in many cases very useful information for discourse interpretation.

2.3 Proposal: Integrate FrameNet and SDRT

Each eventuality introduced in a discourse evokes a corresponding frame in the discourse model. Its frame elements correspond to all relevant (necessary or optional) thematic roles of the event. We propose to include for all core frame elements a representation in the discourse model, i.e. in the SDRS of the current utterance. In case that some participant of a frame is not expressed linguistically, its representation remains underspecified. These elements can be further specified by subsequent information, provided that the discourse referent for the eventuality remains accessible for anaphoric reference. We will spell out in more detail how this works in section 3. Before that, we will discuss how frame elements can be represented in SDRT, and how they help to determine

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3For expository purposes, we will ignore non-core frame elements, as well as the core frame elements Cause and Means, but surely a more sophisticated discourse model must contain additional representations of spatial and temporal coordinates. However, they do not add to the main points we want to make in this paper.
In order to integrate FrameNet data in SDRT, we adopt a neo-Davidsonian style of event semantics (Parsons, 1990), assuming that lexical units expressing eventualities include an implicit event argument in their semantic representation. Thematic roles in an event are represented as conditions in form of predicates, whose first argument is this event argument. For instance, the sentence “John eats an apple” gets a semantic representation $\exists e \exists j \exists a [\text{eat}(e) \land \text{agent}(e,j) \land \text{theme}(e,a) \land \text{john}(j) \land \text{apple}(a)]$. Equipped in this way, we can express the underspecified semantic content of (1) as shown in (3).

According to FrameNet data (Baker et al., 1998), in course of interpreting the utterance, the Killing frame is evoked by the verb “murder”. Its core frame elements show up in the SDRS as $\text{killer}(e_1,x), \text{victim}(e_1,j), \text{instrument}(e_1,y), x = ?, y = ?$. Similarly, the verb “lie” (in its sense “lie nearby”) evokes the frame Being Located, with only one core frame element $\text{theme}(e_2,k)$.

Thanks to the hierarchical structure of the FrameNet database, the Killing frame inherits the properties of the more general abstract frame Transitive_action, which in turn inherits from Event. The frame Being Located inherits the frame elements of the abstract frame State. As assumed in Asher and Lascarides (2003), the occurrence of an event followed by a state is a strong indicator for the presence of a BACKGROUND relation between the discourse segments containing the eventualities. This can be expressed by a default rule (4) (cf. Asher and Lascarides, 2003, p. 207, Vieu and Prévot, 2004, p. 486). Thus, in example (1), a BACKGROUND relation $R$ between $u_1$ and $u_2$ can be assumed.

$$u_1 : \text{event}(e_1) \land u_2 : \text{state}(e_2) \land \text{BACKGROUND}(u_1, u_2)$$

### 3 Resolving Bridging References

Resolving bridging anaphora requires two problems to be solved: (i) the correct antecedent to which the anaphor is to be connected has to be found, and (ii) the nature of the bridging relation itself must be identified. For solving (i), possible antecedents must be identified, and impossible ones must be ruled out. For solving (ii), it is helpful

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6 $\triangleright$ is a nonmonotonic conditional operator. $A \triangleright B$ means: if $A$ then normally $B$. 
to restrict possible relations to conditions on discourse referents already present in
the discourse model or at least evoked.

3.1 Constraints on Anaphoric Reference

Accessibility for anaphoric reference is constrained by general discourse principles such
as the Right Frontier Constraint (RFC, Polanyi, 1988; Webber, 1988). Basically, this
constraint draws a distinction between coordinating and subordinating discourse rela-
tions: a coordinating relation pushes the right frontier to the right, closing off its attach-
ment point, and a subordinating relation extends the right frontier downwards, leaving
open its attachment point. In SDRT, an antecedent for an anaphoric expression must be
DRS-accessible on the right frontier (Asher and Lascarides, 2003). Asher & Lascarides’
meta-rule “discourse structure determines bridging” (see section 2.1) is captured by this
constraint. Recent work on SDRT (Vieu and Prévot, 2004) has revealed that BACK-
GROUND should be considered as subordinating by default. Accordingly, in (1), \( u_1 \) lies
on the right frontier of the discourse, and \( e_1 \) is accessible for anaphoric reference in \( u_2 \).
So the discourse structure tells us that, in principle, a bridging relation can be estab-
lished. Now, the question remains of how to build the bridge between the knife and
the killing event. As seen in the last section, FrameNet data can give important clues
to establish discourse relations. But this knowledge is not always sufficient to resolve
bridging references. In (1), the presence of a BACKGROUND relation alone is not enough
to motivate the bridge. Which further information can we obtain from FrameNet?

The frame element instrument in the killing frame must have a semantic type (in
the FrameNet sense) “physical_entity”. It can be a weapon, but in principle any other
physical entity could be used for killing, e.g. hands (5) or a lamp (6).

(5) John killed Mary. He strangled her.
(6) John killed Mary. He stunned her with a lamp.

On the other hand, the lexical unit “knife” evokes the frame Weapon bearing a semantic
type “artifact”, indicating the possibility that it could serve as an instrument in a killing
event. But as noted in the informal FrameNet description, knives are not necessarily
designed as weapons. So this knowledge does not really help us to resolve the bridging
relation, at least in the present state of FrameNet. The only knowledge we can use is
that there is no clash of semantic types: both knives and killing instruments are physical
entities. As far as that we can capture the intuition behind Asher & Lascarides’ meta-rule
that “bridges must be plausible”. It is little more than saying that interpretations must be
consistent. In fact, as Zeevat (2006) suggests, selecting the most plausible interpretation
given the context and the utterance entails a preference for consistent over inconsistent
interpretations. Thus, using FrameNet data, we at least partly get an approximation to the
plausibility constraint, which, nevertheless, is a probabilistic notion while consistency is
either fulfilled or not. A full, gradual notion of plausibility is surely better captured by
some kind of probabilistic system than by an all-or-nothing notion of consistency.

Looking again at the four meta-rules, we find as first rule “if possible use ident-
ity”. This rule seems to be subsumed by a very general constraint in discourse in-
terpretation, sometimes called DOAP “Don’t overlook anaphoric possibilities”. This principle is essentially stating that if there is an anaphoric trigger, we must try to find an antecedent. This preference can be captured by a general low ranked default saying that, unless otherwise indicated, (semantically compatible) discourse referents can be assumed to be equal. Formal details on how Equality by Default constrains anaphoric reference are described in Cohen (2007).

As noted above, with the presence of a discourse relation between $u_1$ and $u_2$, the discourse referents in $u_1$ are accessible for anaphoric reference in $u_2$. So, with Equality by Default, we can assume that $a$ is equal to $e_1$. Thus, the bridging relation $B(a, k)$ can be specified as $\text{instr}(e_1, k)$. As a byproduct, the underspecified variable $y$ in the condition $\text{instr}(e_1, y)$ in $u_1$ can be resolved to $k$, yielding that instrument and knife refer to the same entity. Although $k$ is not accessible in $u_1$, it is accessible in the superordinated SDRS compromising both utterances, and therefore, after processing the second utterance, the underspecification can be resolved. Note that these inferences are defeasible and can be overridden by subsequent information. Nevertheless, if the bridging relation can be resolved, the discourse turns out to be more coherent. This captures the intuition behind Asher & Lascarides’ fourth meta-rule “maximize discourse coherence” (MDC). Now consider discourse (7).

(7) a. John was murdered yesterday. b. # The book lay nearby.

This discourse is - in a neutral context - less coherent than (1), and we would like to explain why. In example (1), the knowledge that a knife is a kind of weapon that can serve as an instrument in a killing event licenses the bridging inference. In example (7), such a connection cannot be found. Again, a BACKGROUND relation can be inferred, but the role that “the book” could play in the killing event is less clear than that of a knife. Although there is no clear semantic connection between “the book” and any evoked core frame element, there is no clash of semantic types, and a bridging relation to the instrument could be plausible. Nevertheless, as no sense of “book” evokes a frame similar to $\text{Weapon}$, it remains unclear what nature has the bridging relation, and the discourse seems less coherent. Note again, if the context provides additional evidence that the book is a probable killing instrument, e.g. by being contaminated with poison, the bridging inference indeed can be drawn. To summarize the principles we need for bridging resolution, we remain with the following constraints on anaphoric reference:

- DOAP
- PLAUSIBLE or CONSISTENT
- RFC
- MDC

Note that they are not meant to be special meta-rules designed for bridging resolution, they rather seem to be more general constraints to be obeyed in discourse interpretation. They could be seen as constraints in optimality theoretic pragmatics, but we will not adopt a particular framework here, as we leave open the question whether the
ranking of these constraints should be left as stated above. For a related discussion, see Zeevat (2006).

### 3.2 Weak Discourse Referents

For illustration, a pragmatically enriched SDRS for discourse (1) is shown in (8). Note that as the murderer is not mentioned at all, his referent could not be resolved and its representation remains underspecified.

\[
\begin{align*}
\text{(8)} & \quad u_1 : e_1, j \mid x, y \\
& \quad \text{john}(j), \text{murder}(e_1) \\
& \quad \text{killer}(e_1, x), \text{victim}(e_1, j), \text{instrument}(e_1, y) \\
& \quad x = ? \\
& \quad u_2 : e_2, k \mid B, a \\
& \quad \text{knife}(k), \text{lie.nearby}(e_2), \text{theme}(e_2, k) \\
& \quad \text{B}(a, k), \text{B} = \text{instrument}, a = e_1, k = y \\
& \quad \frac{k'}{\text{knife}(k')} \Rightarrow \frac{k'}{k} \\
& \quad \text{BACKGROUND}(u_1, u_2)
\end{align*}
\]

As suggested by the SDRT representations, we now have to deal with two different kinds of discourse entities: **regular** discourse referents introduced by linguistic expressions, and **weak** discourse referents which are not (yet) expressed linguistically. **Weak Discourse Referents** are abstract entities which are evoked or activated in course of the interpretation process. A linguistic expression does not introduce them directly, rather indirectly by virtue of the frame evoked by a lexical unit. They often remain underspecified, but can be specified by subsequent anaphoric reference. This is what happens with the killing instrument. Its identification with the knife helps to render the discourse more coherent. If the knife in the second sentence had nothing to do with the first sentence, the discourse would be rather incoherent, at least after uttering the second sentence.

The distinction between two types of discourse referents is not entirely new, e.g. Kamp and Rossdeutscher (1994) assume “schematic discourse referents”. Furthermore, this assumption could be generalized in the sense that all discourse referents are assigned finer-grained weights on a scale according to their salience, instead of distinguishing just two kinds of referents. We leave this point to further investigation.

Our proposal is to restrict the search space for suitable antecedents for bridging anaphora to take into account only accessible regular and weak discourse referents. In this way, the resolution of bridging inferences can be considerably constrained. In our model, new entities are (weakly) introduced with every eventuality that is talked about, with the potential to be strengthened, to remain in the background, or even to be dropped.
4 Related Approaches

4.1 Implicit Arguments as A-definites
(Koenig and Mauner, 1999)

Important work on the discourse status of non-expressed event participants was presented by Koenig and Mauner (1999), who build upon results of psycholinguistic experiments concerning implicit verbal arguments. Reading times of sentences like (10) following one of the sentences in (9-a) were compared in an experiment carried out by Mauner et al. (1995)

(9)  a. A ship was sunk
    b. A ship sank
    c. A ship was sunk by someone
(10) ... to collect settlement money from the insurance company.

Subjects take longer to process rationale clauses like (10) when they follow intransitive sentences like (9-b) than when they follow short passives (9-a) or agentive passives (9-c). Thus it seems that verbs like “sink” in (9-a) include an implicit actor argument as part of the representation of the lexical item, and the implicit anaphoric (PRO) subject of “collect” in (10) can be anchored more easily in the discourse model. Koenig and Mauner (1999) claim that implicit arguments, as well as words like the French subject clitic “on”, the German “man”, and indefinite uses of English “they” (a-definites in their terminology), cannot serve as antecedents of anaphora and do not introduce any discourse referent at all. Their DRT representation for sentence (9-a) is (11):

\[
\frac{y}{\text{ship}(y), \text{sink}(x,y)}
\]

In this representation, it remains unclear how the apparently free variable x, representing the actor, is model-theoretically interpreted. Moreover, as noted in their paper, bridging references to implicit arguments are indeed possible, e.g. consider example (12).

(12)  a. They killed the president.
    b. The terrorists were merciless.

Koenig and Mauner (1999) do not give any details on how such an inference can be drawn according to their theory. The interpretational apparatus of DRT (Kamp and Reyle, 1993) would have to be changed in order to allow uninstantiated variables in final DRSs. Such an attempt is made by Farkas and Swart (2003). Here, we want to refrain from a major modification of truth conditions in DRT.

4.2 Bridging as Coercive Accommodation (Bos et al., 1995)

Bos et al. (1995) presented an approach that is indeed very close to our proposal. Basically, they combine an extension of van der Sandt (1992)’s theory of presupposition with
the *Generative Lexicon* (Pustejovsky, 1995), comparing bridging with Pustejovsky’s *coercion*. This approach is based on a convincing formal definition of an extension of DRT. However, the treatment of bridging as a lexical phenomenon is not unproblematic. It is limited to lexically induced bridging inferences. Bos et al. (1995) show example (13) as a limitation case of their approach.

(13) Probably, if Jane takes a bath, Bill will be annoyed that there is no more hot water.

Interpreting this short discourse involves the inference that taking a bath involves using a hot water reservoir. This inference is difficult to explain in Bos et al. (1995)’s framework. Regarding FrameNet, in the present state of English FrameNet it is unclear whether phrasal verbs are lexical units and how they evoke frames, e.g. whether “take a bath” counts as a lexical unit, or just “take”. However, in other versions of FrameNet, such knowledge is encoded; an equivalent sentence in Spanish using the verb “bañarse” (to take a bath) is analyzable in FrameNet terms. There, it evokes the frame *Cause_to_be_wet* with a core frame element *Liquid*, which can be instantiated by “hot water”. Still better is a suggestion made by the developers of Polish FrameNet, according to which both “wziąć kąpiel” (like in English) and “wykąpać się” (like in Spanish) evoke the frame *Grooming*, where an *Agent* engages in personal body care. An *Instrument* can be used in this process as well as a *Medium*. Thus, if “take a bath” is treated as a lexical unit, we can draw the inference that the water in the second clause is used for the bath in the first clause.

(14) Yesterday, Chomsky analyzed a sentence on the blackboard, but I couldn’t see the tree.

Moreover, as Piwek and Krahmer (2000) note, not all implied antecedents are lexical entailments; sometimes, non-lexical background knowledge is needed, as in (14). To correctly understand this utterance, the hearer has to rely on specific background knowledge, in particular on the knowledge that a generative syntactic analysis typically involves a tree-like representation of the sentence. It is questionable whether highly context-sensitive information of this kind is part of the lexicon. In any case, FrameNet provides us with additional secondary information which surely is beyond the lexicon but still has an influence on resolving bridging anaphora.

5 Conclusion

We have sketched how SDRT’s account of bridging can be extended in order to cover reference to eventualities. SDRT and FrameNet are combined by assuming a neo-Davidsonian event representation and distinguishing two types of discourse referents. We could indicate that the meta-principles assumed for bridging can be put down to more general constraints to be obeyed in discourse interpretation. We have spelled out

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7 see http://gemini.uab.es/
8 Magdalena Zawisławska, p.c.; see http://www.ramki.uw.edu.pl/
how world knowledge, represented in frames, contributes to the interpretation process, both for establishing discourse relations and for resolving indirect anaphora.

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References


Explaining Conjunction Systems: 
Russian, English, German

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Abstract
The paper analyses the Russian conjunctions i, a and no, the English conjunctions and and but and the German conjunctions und, aber and sondern in terms of specialised additivity: special cases of the relation between sentences expressed by too and also. The first section gives an overview of the analysis, the second section tries to give an explicit characterisation of additivity and its specialisations. The third section uses an OT-like framework to explain the complementary distribution of the conjunctions and the blocking effects that result.

1 Conjunctions

A much debated issue in Russian linguistics is the precise demarcation of the conjunctions i, a and no. I corresponds to the English and, a has to be translated sometimes as and and sometimes as but, where all the uses of no seem to correspond to English but. We refer to Jasinskaja and Zeevat (ms) for an attempt to do justice to the descriptive problems and the debate. In this paper, we try to look at the theoretical side of the proposal. That comes down to the semantical analysis of additivity and an account of the blocking of one conjunction by another that is needed to make the explanation work.

The theory can be recapitulated as follows.

The English and is a general marker of additivity. Additivity is a property of a clause to give a distinct answer to a question that was already addressed before. If the question contains a single wh-element, the additive clause and its antecedent must give distinct values to the wh-element. If the question has more than one wh-element,
the additive clause and its antecedents give distinct values to each of the wh-elements—otherwise, it can still be additive, but with respect to the corresponding question with fewer wh-elements. The theory assumes that polar questions have wh-elements and are wh-questions that can take values from the set of truth-values. Accordingly they will be called whether-questions.

The conjunction and is indifferent to the number of wh-elements and the type of these wh-elements. But and competes with but that is a special case of additivity asking for questions with at least two wh-elements of which one must be whether. (1) gives an example of a who-whether-question, which can be split into two whether-subquestions: whether John likes football, answered by the first conjunct, and whether Bill does, answered by the second.

(1) Who “whether” likes football?
John does, but Bill doesn’t.

The Russian system is more complex. The conjunction i requires a single wh-element in the question. The conjunction a can be taken as the generic additive marker (like and) that is blocked from single wh-questions by the presence of i and from the case covered by no by the presence of that marker\textsuperscript{1}. No marks additivity with respect to a why-whether question. That means that the first conjunct gives a reason for some statement C and the second one a reason why C should not be adopted. This makes the argumentative function of no the basic one and constructs the denial of expectation-reading as the case that C is identical to the second conjunct.

(2) Why “whether” should we buy this ring?
It is beautiful, but (russ.: no) expensive.
Why “whether” didn’t John make it?
He wanted to come, but (russ.: no) did not make it.

Whether-questions are special. Distinctness implies that there cannot be conjoined distinct answers to a single whether-question. They would have to answer yes and no to the same question and would be contradictory. But there can be conjoined answers to double wh-questions with one of the elements being whether.

A special case are correction markers like sondern in German (Spanish has a similar marker sino).

(3) Peter ist nicht in Berlin, sondern/*aber in Paris.
Peter is not in Berlin, but in Paris.
Peter ne v Berline, a v Pariže.

These are a special case of distinct answers to double wh-questions with one of the elements being whether, in (3) a where-whether-question: where whether is Peter? It provides the negative answer to whether Peter is in Berlin and a positive answer to whether Peter is in Paris.

\textsuperscript{1}In Jasinskaja and Zeevat (ms), i is taken to be the unmarked case, and a as the special case. It is however i that has the simpler semantics and it is hard to see how the property of marking for additivity with respect to multiple wh-questions can grammaticalise, while many additive particles allow only a single associate and provide a good source for conjunctions like i.
whether Peter is Paris. *Sondern* marks *wh-whether*-questions with a correction presupposition: the first conjunct is presupposed (and denied by the second). Typically, in languages like Russian, where *a* has to do the job, the presupposition is not marked and the correction can be made in both orders.²

(4) Peter v Pariži, *a* ne v Berline.

Double *wh*-questions in Russian select *a* and not *no* because *no* requires both *why* and *whether*. This is not even satisfied in (5): John hits Peter in both conjuncts.

(5) John did not hit Peter because he was angry, but because he was drunk.

The conjunction answers: whether John hit Peter because of what? (*a* *whether-what*-question) by two doubly distinct answers. It would be *sondern* in German and *a* in Russian.

In providing different answers to the same questions, conjunctions belong to the class of additive markers, like *too* and *also*. Zeevat and Jasinskaja (2007) argue that some *and*-like conjunctions can be historically related to additive particles and need additivity for the proper understanding of their behaviour.

Blocking is the final ingredient of the explanation. If *no* or *i* can be used, *a* cannot. If *i* cannot, *a* must be used, if *but* can be used, *and* cannot.

Given these ingredients, it is possible to give a parsimonious description of the Russian system, the English system and the German system and correlate them as shown in table 1. It follows that *no* always translates to *but*. *A* translates as *but* and *aber* if one of its *wh*-elements is *whether*, unless one of the conjuncts is presupposed to be false (in the common ground or in the interlocutor’s information state) in which case it is rendered by *sondern* and the presupposed conjunct is preposed. Otherwise, *a* translates as *and* and *und*. *I* always corresponds to *and* and *und*. *Sondern* always translates as *a* and *but*.

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²The presupposition of the first conjunct is also missing in the English *but*, nevertheless *but* shows a slight preference for the negative-positive order of conjuncts under the correction reading, cf.: *Peter did not go to Paris, but to Berlin* vs. *Peter went to Berlin, but not to Paris*. Umbach (2004) claims that in the latter case the positive-negative order is only compatible with the non-corrective reading: Peter did not go to Paris in addition to (rather than instead of) going to Berlin, which in our theory results just from answering a *wh-whether*-question without any additional presupposition. The correction reading with the positive-negative order is conveyed better by using *and*: *Peter went to Berlin, and not to Paris*. This difference between the English *but* and the Russian *a* could be related to the asymmetry of the conjuncts of *but* that also shows up in its argumentative and denial of expectation uses like (2). An account of this asymmetry is presented in section 3.
Aber is always translated into English as but. Into Russian it translates as a unless it answers a why-whether-question in which case it becomes no. And translates as i if it marks lwh and as a otherwise and in German to und. These translation relations are illustrated below.

wh1:

(6) Vera prinimala vannu, i razgovarivala po telefonu.
Vera was taking a bath and talking on the phone.
Vera nam ein Bad und telefonierte.

(7) Idet sneg, i duet veter.
It is snowing and the wind is blowing.
Es schneit und der Wind weht.

wh>1:

(8) Vera prinimala vannu, a Lena razgovarivala po telefonu.
Vera was taking a bath and Lena was talking on the phone.
Vera nam ein Bad und Lena telefonierte.

(9) V Moskve idet sneg, a v Amsterdam duet veter.
It’s snowing in Moscow and it’s windy in Amsterdam.
In Moskau schneit es und in Amsterdam weht der Wind.

(10) Oleg ljubit futbol, a Roma basketbol.
Oleg likes football and Roma likes basketball.
Oleg spielt gern Fussbal und Roma Basketball.

wh-whether:

(11) Oleg ljubit futbol, a Roma ne ljubit.
Oleg likes football, but Roma doesn’t.
Oleg spielt gern Fussball, aber Roma nicht.

why-whether:

(12) Èto kol’co krasivoe, no dorogoe.
This ring is beautiful, but expensive.
Dieser Ring is schön aber teuer.

wh-whether correction:

(13) Peter ne v Berline, a v Pariže.
Peter is not in Berlin, but in Paris.
Peter ist nicht in Berlin, sondern in Paris.
2 Additivity

The first formal semantics of additivity has been provided by theorists of presupposition like Gazdar (1978) and Karttunen and Peters (1979) who assigned to additive particles associating with a name the property that an object non-identical with the referent of the name also has the property that is expressed by the rest of the clause. This is too restrictive since additive particles also associate with other NPs and other constituents and even with sequences of NPs. Also the property of being non-identical seems too weak in two respects: for sequences there must be additivity at each coordinate and following Hendriks (2004), there should be more than just non-identity: the two elements should not overlap: John’s hand cannot be in addition to John, a part of the content of a bottle of milk cannot be in addition to the content itself, an event cannot be additive with respect to a subevent. (14) is an illustration.

(14) John is coming. His whole family is coming (*too).

A third failure of these accounts is that they allow accommodation and satisfaction by common ground knowledge, something criticised by Kripke (ms) by the example (15).

(15) Tonight John is having dinner in New York too.

Kripke’s point is that (15) is not acceptable out of the blue, even though everybody knows that there are millions who have dinner every evening in New York. Too seems to require an overt antecedent in the context and the property that allows and necessitates the occurrence of too would be that the clause readdresses a question that has already been addressed in the discourse. This gives the following definition.

(16) **Definition 1:**

ϕ(a) and ϕ(b) are additive to each other with respect to ?x ϕ in w iff
(1) both are true in w and answers to ?x ϕ.
(2) and there is no c such that c ≤ a and c ≤ b

This is one-place additivity. A more general definition is needed to capture additivity on pairs (and more generally, tuples) as in the examples below:

(17) A: I love you.
     B: I love you too.

(18) Tim loves Louise and Sandra.
     Sandra loves him too.

The tuples need to be distinct in each of the corresponding elements, that is why (19c) is infelicitous with too. It cannot be construed like (19a) as one-place additive (John is another person loving Sandra). While (19b) can be construed in terms of two-place additivity (⟨John, Monique⟩ is another pair standing in a love relation whose every element is distinct from the corresponding element in ⟨Tim, Louise and Sandra⟩),3 (19c) cannot because Sandra and Monique has a common part with Louise and Sandra.

3For some speakers too can only associate with a single constituent (Krifka, 1999, n. 7), however others accept (19b) with the reading where too associates with the pair of constituents John and Monique, giving rise to two-place additivity.
(19) Tim loves Louise and Sandra.
   a. JOHN loves Sandra, too.
   b. JOHN loves MONIQUE, too.
   c. JOHN loves Sandra and MONIQUE, (*too).

   A general definition of additivity uses questions of the form \(?x_1 \ldots x_n \varphi\) with \(n \geq 1\).

(20) **Definition 2:**

\(\varphi(a_1 \ldots a_n)\) and \(\varphi(b_1 \ldots b_n)\) are **additive** to each other with respect to \(?x_1 \ldots x_n \varphi\) in \(w\) iff

1. both are true in \(w\) and answers to \(?x_1 \ldots x_n \varphi\).
2. for all \(1 \leq j \leq n\) there is no \(c\) such that \(c \leq a_j\) and \(c \leq b_j\)

This would be general additivity and correspond with markers like *and* and *und*, apart from blocking effects. If \(a\) is the default case, it is also just a general marker of additivity like *and* and *und*, but subject to more blocking. All the other markers discussed, including *too* are more restricted by putting more constraints on the number of *wh*-variables or on the type of these variables.

**Some remarks on the definition:** First of all, the definition appeals to a notion of \(x \leq y\) which needs further motivation. Intuitively, distinctness between objects is about not sharing parts. There are a number of part-relations that are relevant. The following list seems to cover the most important cases.

1. objects and their constituent parts
2. set of objects and their subsets and elements
3. quantities of matter (some bread) and the subquantities that make them up
4. events and the subevents that constitute them
5. states and their component states
6. regions and their subregions
7. temporal intervals and their subintervals
8. truth values have no parts

This suffices for the *wh*-phrases considered here. *Why* takes events and states as values, *who* persons, *what* non-human objects, *when* and *where* spatial and temporal regions. The problems are mainly with abstract objects like habits, tendencies, dispositions, propositions and properties\(^4\).

\(^4\)A good deal of progress can be made by a reduction to their instances. If an instance of a property invariably or typically has another property that property could count as a part or a prototypical part of the property. If a proposition is true in virtue of events or states with invariable or prototypical subevents that make another proposition true, the other proposition is a part or prototypical part of the proposition. And the same would hold for habits, tendencies, and dispositions.
Second, the definition is about objects and not about generalised quantifiers, the general case of an NP meaning. The idea is that a linguistic answer with a generalised quantifier as a value for the wh-variable can always be witnessed in a world by an object answer.

This works as follows: If $\varphi(a)$ is true in $w$ and $w \models N(a)$ ($N$ is the meaning of a noun) then $\varphi(a)$ will witness a whole range of sentences of the form $(\neg)Q\varphi(x)$ ($Q$ is a determiner meaning). Which determiners are witnessed (possibly under a negation) depends on the size of $a$ and the size of the extension of $N$ minus $a$ and (sometimes) on contextual standards of comparison.

Let $\varphi(a)$ be true in $w$ and $a$ be in the extension of $N$ in $w$.

Then

1. $\varphi(a)$ witnesses some $N \varphi(x)$ in $w$
2. $\varphi(a)$ witnesses all $N \varphi(x)$ in $w$ iff $a$ is the extension of $N$ in $w$
3. $\varphi(a)$ witnesses $3 \ N \varphi(x)$ in $w$ iff $a$ has size 3
4. $\varphi(a)$ witnesses many $N \varphi(x)$ in $w$ iff $a$ has a large size
5. $\varphi(a)$ witnesses most $N \varphi(x)$ in $w$ iff $a$ outsizes the set of members of the extension of $N$ in $w$ which do not satisfy $\varphi(x)$
6. $\varphi(a)$ witnesses few $N \neg \varphi(x)$ in $w$ iff $a$ is nearly all of the extension of $N$ in $w$.

Given an information state $X \subseteq W$, the sentences with NP semantics are additive with respect to the question, if they can be witnessed by additive object answers to the question, in each world $w \in X$.

The definition also does not directly allow for pragmatic additivity, where the additivity holds not with respect to the common ground or the speaker’s information state but with respect to the hearer’s information state, as in (21).

(21) A: Did you invite the mayor and the doctor?
    B: Well, the mayor is the doctor. So by inviting the mayor I invited the doctor too.

Thus in the most general terms, the conditions licensing additive marking can be characterised as follows:

(22) The context must contain an answer $A$ to a question $\varphi(x_1 \ldots x_n)$ and the contribution $B$ of the speaker must be witnessed by an additive answer with respect to the information state of the hearer as it is known to the speaker.

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5Lexical — unlike the grammaticalised markers considered in this paper — expressions of additivity like “in addition” or “additionally” enforce additivity with respect to the common ground after the update: i.e. additivity is part of the truth-conditional content of the utterance. Another difference is that they do not need to have an additive antecedent, but can introduce it or accommodate it.
Additive conjunctions vs. additive particles: The additive conjunctions considered in this paper are special in that the antecedent is always the first conjunct and that the question is directly related to the goal of the speaker in producing the conjunction. This does not need to be the case for normal additive marking with *too* and *also*.

The speaker can answer a question with his contribution that is different from the question which makes his contribution additive as in (23).

(23) What did Susan do?
    SUSAN had spaghetti TOO.

The speaker answers the question but in producing the answer also readdresses the question who ate spaghetti and marks the fact that he is readdressing it with the additive marker.

Specialisations of additivity: The first kind of specialisation is simplex vs. duplex (multiplex) questions. *I* marks single *wh*-questions, *no* the particular case of double questions with *why* and *whether* as the two *wh*-elements. The Russian *a* does not impose any restriction on the number of *wh*-elements *per se*, but because of blocking by *i* it is only possible with multiplex questions. All the other conjunctions do not have a restriction on the number of *wh*-elements with or without blocking.

The second kind is typing. The *wh*-variable in a question can allow only values of a certain type, like object, event, truth-value, region, quantity etc., corresponding to *wh*-words like *who*, *why*, *whether*, and *which*, *whether*, *where*, *how much* and others. Polar questions are treated as normal *wh*-questions. This is not problematic, *whether p* gets the logical representation: \(?x_t \text{ext}(p) = x_f.\)

*Whether*-questions are a special case: the only way to be a distinct truth-value is to be the other truth value. This makes it impossible to have simplex additivity of type truth-value: one would affirm and deny the same statement. But duplex and multiplex questions can include a type truth-value: it is possible that *P* holds of *x* but does not hold of *y*.

There is a similar problem with *why*-whether*-questions*. If *A but B* addresses *Why whether p?* and *A* addresses the positive side, i.e. *A* gives a reason for *p*, and *B* a reason for \(\neg p\), then the answer does not decide the *whether*-question. Markers like *but* are however implicating that *B* is the decisive part. So if *B* gives a reason for \(\neg p\), the speaker implies that \(\neg p\) is true or should be the decision that has to be taken.

3 Blocking

As described in section 1 the various specialised additive markers block each other when their condition of application is more specific: *but* is preferred to *and* when the conditions for *wh*-whether hold, even though *wh*-whether is also compatible with the weaker conditions imposed by the generalised additive marker *and*. Similarly, *i* and *no* block *a* in Russian. In German, *sondern* blocks *aber*, which is otherwise very similar to English *but* or Dutch *maar*. 
How does this happen? It is not a general property of natural language that what is more specific in semantics is preferred. It is not necessary to refrain from calling Bill a man, if he is an actor and a bachelor. Blocking is known from morphology (the more specific rule that makes the plural of *goose* *geese* wins from the more general rule that would make *gooses* out of *goose*). But the system of conjunctive markers is not normally seen as a paradigm.

It could however be compared to a paradigm. The present of the verb *to be* is the paradigm *am, is* and *are*. For the negation, the form *amn’t* is missing and gives way to *aren’t* in *Aren’t I clever?*. This makes *are* and *aren’t* into the unmarked form and lets the special forms *am* and *is* come out of a constraint that tries to realise the input features of number and person on the output form, when this is possible. Bresnan (2000) employs a constraint AGR for this purpose.

We could do the same, by assuming that AGR tries to realise a special category of features on conjunctions. Candidates for such features would be WHETHER, 2ND (second), SINGLE, WHY and CORRECTION with our conjunctions realising these features as in the following table 2. WHETHER requires that one of the *wh*-elements be typed as truth value, 2ND makes the second conjunct resolve the whether-issue, WHY types one of the *wh*-elements as a proposition giving an argument for φ, SINGLE restricts the number of *wh*-elements to one, and CORRECTION introduces the presupposition of the first conjunct characteristic of corrections.

Unfortunately, conjunctions are not obligatory as such. Quite systematically, conjunctions of any type can be replaced by two adjacent unmarked sentences.

(24) John came and Mary left.
    John came. Mary left.
    John is tall but Bill is small.
    John is tall. Bill is small.
    Johann ist nicht in Paris, sondern er ist in Berlin.

This makes the problem different from agreement marking. There is nothing optional about agreement, at least in English, while additive conjunctions can be left out if distinctness is obvious from the context or signalled by other means, e.g. by additive particles like *too* and *also*, or adjectival markers like *another, a different*.

The paradigmatic approach also does not explain why the system emerged. For the verbal agreement system, it is generally accepted that the agreement morphemes come from fusion of the verb with pronouns and would be remains of clitic doubling. It
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needs to be explained of course why such remains are stable, but there is a general explanation that applies here: the agreement morphemes mark finiteness and their presence increases semantic redundancy and therefore supports understanding. It seems wrong to consider the conjunction systems to be atavistic remains of any other paradigm, even though they do make understanding more robust.

Another approach is to assume a maximisation constraint MAX(OTHER) that checks that the items that are distinct in the input are also distinct in interpretations of the output (see Zeevat, 2003). The check can be understood as part of the self-monitoring of the speaker and is here directed to checking that objects are not identified in interpretation when this is not intended. The constraint is closely related to the fact that perception is strongly oriented towards identification: identify when there is no reason not to. Pragmatic formulations of that principle are *NEW (Zeevat, 2008), DO NOT ACCOMMODATE (Blutner, 2000) and DOAP (Williams, 1997; Hendriks and de Hoop, 2001). The approach by MAX(OTHER) however also runs into a number of problems.

Distinct objects can be associated with different descriptions, but if they share descriptions, it is necessary to use a marker of distinctness like other or different. If the same predicate applies to a different object, it is necessary to employ an additive marker. It is important to realise that in these cases there can be plenty of other cues to infer that the objects are different. In (25), the two men need to be different because one cannot non-metaphorically meet oneself, because a full NP cannot be coreferential with another NP in the same clause and because indefinites introduce new referents.

(25) A man met another man.

The interpretation of the phenomenon as a max-constraint does not work in these cases precisely because of the fact that distinctness can be completely clear and the marker is still needed. The rule seems to be that other (or an equivalent marker) needs to be used if there is another object with the same description.

The same point can be made about additive marking by particles. In (26), the different names are sufficient to guarantee that John and Bill are distinct people.

(26) John went to the party. Bill went too.

So it is best to see other-marking and additive-marking as production constraints along the following lines.

(27) **OTHER:** mark the re-use of the same description for a different object

(28) **ADD:** mark the application of the same predicate to a different object

That does not mean that MAX(OTHER) is not involved. The existence of lexical markers together with MAX(OTHER) would be responsible for the formation of the grammaticalised markers and the production constraints as partial grammaticalisations of MAX(OTHER). The pattern would presumably be that the markers appeared sufficiently often in response to MAX(OTHER) that their absence started being a signal that there is no OTHER. This forces the emergence of these production constraints, since the
Explaining Conjunction Systems: Russian, English, German

Table 3: Blocking in the conjunction systems of English, German, and Russian

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<th>English:</th>
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<td></td>
<td>and</td>
<td>¬ (WHETHER, 2ND)</td>
<td>i</td>
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<td>but</td>
<td>WHETER, 2ND</td>
<td>a</td>
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<td></td>
<td></td>
<td>und</td>
<td>¬ (WHETHER, 2ND)</td>
<td>no</td>
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<tr>
<td></td>
<td></td>
<td>aber</td>
<td>WHETER, 2ND ¬ CORRECTION</td>
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<tr>
<td></td>
<td></td>
<td>sondern</td>
<td>CORRECTION</td>
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The probability of misunderstanding increases with the signalling function of the absence of the marker.

The same would be applicable in the case of conjunctions: conjunctions grammaticalise in response to MAX(OTHER) as additive markers. Specialised additive markers can grammaticalise because they mark distinctness even better (type, number) and MAX(OTHER) is then responsible for a pragmatic preference for the specialised marker in favour of the less specialised marker when they are in competition.

For the choice to leave out any conjunction, one has to assume that there is no other principles than MAX(OTHER) involved in conjunction (unlike the additive particles and adjectives discussed above). Not marking is then possible, if the distinctness is sufficiently clear from other cues (which may include additive and contrastive particles, intonation, choice of lexical items, overtesss of the question addressed etc.). MAX(OTHER) by itself would allow the use of the less specialised conjunction when more specialised conjunctions can be used, if there are enough cues to infer the distinctions.

The way out is to assume that the non-specialised markers have become signals that the more specialised markers do not apply. This will happen if in fact MAX(OTHER) would make the specialised marker dominant over the general marker in the cases where the specialised marker can apply. There is a legitimate probabilistic inference from not using the more specialised marker to the assumption that the conditions for its use do not hold.

This would turn our earlier table 2 into the schemata shown in table 3.

There is some evidence for setting it up in this way in the interpretations that arise when and is used in situations that seem to require but, or a in situations that seem to require no, or aber in the situations that seem to require sondern.

An empirical observation about why-whether-conjunctions (expressed by but, no or aber) is that the second conjunct decides the issue, in the sense that the speaker indicates that the second argument is better than the first (Anscombe and Ducrot, 1977). This is illustrated in (29). This observation is not a consequence of the theory presented in this paper and may perhaps be explained by the fact that if one of the two conjuncts is
old, it should be the first. In that case, the speaker adds a new argument for consideration in the second conjunct, presumably because she deems it important enough to be considered. The preference of the speaker for the course of action advocated in the second conjunct can therefore be inferred and the standard ways of expressing why-whether-conjunction can become signals of this conclusion. In the schema, this corresponds with the feature 2ND.

(29) The ring is beautiful, but expensive. (Let’s not buy it)  
    The ring is expensive, but beautiful. (Let’s buy it)

    If one assumes that the conventional markers of why-whether-conjunction indeed signal the decisiveness of the second argument for the speaker, replacing the marker by a less specific one would cancel the effect, as in (30) under the assumption that the question of buying the ring or not is at issue.

(30) The ring is beautiful and expensive. (I don’t know what to do)

This may give the explanation of the mirative uses of and and a.

(31) Max can’t read and he’s a linguist.
    Her husband is in hospital and she is seeing other men.
    Leto, a idet sneg.
    It’s summer and it’s snowing.

    In all these cases, but (no) is possible with a why-whether-reading: Why whether Max can read?: he should because he is a linguist, he does not because (it is known that) he cannot. The point is to establish the second conjunct and protect it from the expectation arising from the first conjunct.

    It can be argued that this is the proper content of the feature 2ND: it makes the conjunction marked by no, but or aber a contribution to the issue whether C? given by the why-whether-question Why whether C? and lets the second conjunct resolve that issue. In the cases at hand, C is identical to the second conjunct B. The negation of 2ND will then in general stop the conjunction from being a contribution to the issue whether C and thereby remove the special role of the second conjunct. In the examples of (31), this means that the issue addressed by the whole conjunction is not whether B? but something else. (32) provides some possible alternative issues. The examples all seem to be of the kind that denies a rule: linguists can read, wives behave when their husband is in hospital, it doesn’t snow in summer. These rules are precisely the ones evoked in the first conjunct by interpreting the conjunctions, just like their variants with no, but and aber as giving distinct answers to why whether B? and relate directly to the wider issues assumed in (32).

(32) Are linguists any good?  
    Is she a good person?  
    Is the weather as it used to be?

    While we think that this is an attractive option and the alternative of postulating that a lexically codes for a mirative reading is unappealing, there is reason for doubt. A variant of an example by Blakemore and Carston (2005, p. 571) is (33).
A: Loose rugs are pretty harmless.
B: Well, John slipped on a Persian rug and he broke his leg.

Mirative uses of *and/a* like those in (31) usually can be paraphrased with *but/no* with the loss of mirativity, but (33) cannot be paraphrased by (34), which means that it cannot be addressing a *why-whether* question. It is not clear though that (33) is an instance of a mirative use of *and*.6

(34) (???) John slipped on a Persian rug, but he broke his leg.

How about the other cases? Does *and* mean \(\neg\) *(WHETHER, 2ND)*? Does *aber* mean \(\neg\) *CORRECTION*? Does *a* mean *multiple*? The prediction that they do have these additional effects is confirmed. Assigning *a* the meaning of *DOUBLE* is the most frequent line taken by the tradition on *a*, often next to other readings (Jasinskaja and Zeevat, ms). Apart from the mirative uses which were analysed above as avoiding the feature *2ND, and* is not used for arguing in different directions. For *aber*, consider example (35).

(35) Johann is nicht in Paris, sondern/aber bei seiner Frau.
John is not in Paris, but (he is) with his wife.

With *sondern*, John is with his wife instead of being in Paris. In particular, the sentence implies that John’s wife is not in Paris. With *aber*, there is an expectation that John would be both in Paris and with his wife (because his wife lives in Paris), but contrary to this expectation, John is with his wife outside Paris. The fact that such non-correcting interpretations arise is predicted by the assumption that *aber* signals the absence of correction.

It is consistent to assume that these three effects of blocking arise by reasoning about alternatives, as e.g. in scalar implicatures, but if that is so one would expect similar effects: extra processing costs and the possibility of cancellation. It seems unlikely that there are such effects, but we are not aware of any empirical studies in this area.

4 Conclusion

This paper tried to show that additivity can be seen as a common “semantics” for the conjunctions under consideration. For this purpose it is necessary to define additivity as the property of giving an answer that is distinct on each dimension corresponding to a *wh*-element \(x_j\) of a question \(?x_1 \ldots x_n \varphi\).

While there seems to be no other way to deal with the problem given by the example “I love you too” and the conjunctions discussed in this paper, it is a bit of a mystery why this is the crucial notion and not the simpler one: distinct answer to the same *wh*-question. It can be argued that blocking is again at work: for a good representation of the relations involved, it may be mandatory to construct answers constituted by distinct

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6*I* is quite possible in Russian for this example. This suggests that this is probably not a mirative use, which would require *a* in Russian.
tuples that coincide on one of their elements (e.g. \langle John, Mary \rangle and \langle John, Susan \rangle) to be additive with respect to the question with one wh-element removed. This makes the distinctness marking that is the most probable functional advantage of additive marking unoperative for markers that do not have a fixed arity, such as and, und and a, while at the same time providing a functional motivation for the markers with a fixed arity (i, no, aber, but and sondern).

The account of blocking by means of extra meaning being generated by the same process that generates complementary distribution patterns needs further explanation. The departure point is the situation that the default marker of additivity competes with the specialised marker and that pragmatics decides whether the specialised marker is used: the speaker judges that he will be misunderstood without the special marker. This in turn turns the generic marker into a stochastic signal that the specialised meaning is not intended. The stochastic signal pushes up the probability of misunderstandings arising with the use of the generic marker for the special case. This will increase the frequency with which the speakers will judge that they will be misunderstood in that particular case. The end result is a complementary distribution and the generic sign being a categorial signal that the specialised meaning does not obtain. The argument is identical to the model of grammaticalisation proposed in Zeevat (2006).

References


One More Step and You’ll get Pseudo-Imperatives
Right

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Abstract
We consider pseudo-imperatives like Come near (and) I’ll show you, which have a conditional interpretation (‘if you come near, I’ll show you’). We show that they have basically the same semantics as Sufficiency Modal Constructions studied by von Fintel and Iatridou (2007). We provide a detailed analysis of ‘sufficiency’ in Lewis’s counterfactual framework, extending the analysis to pseudo-declaratives. We discuss the possible origins of the construction and offer a characterisation of the syntax-semantics interface.

1 Introduction

Pseudo-imperatives (P-imperatives) are structures of the form A-IMP B or A-IMP and B, where a conditional interpretation is possible, as in (1).

(1) a. Come near (and) I’ll show you
   b. If you come near, I’ll show you

It has been proposed that the morphologically imperative constituent does not convey a separate speech act of command, permission, etc., but combines with the second constituent to form a conditional unit, see Franke (2008) and Russel (2007) for recent references. This is specially useful to deal with contrasts noted by van der Auwera (1986) between A and B and A or B structures.

Unfortunately, it turns out that there are other, unexpected restrictions on the semantic relation between A and B in P-imperatives. Roughly speaking, A (and) B sounds strange whenever the causal relation between A and B is perceived as ‘weak’, in a sense to be clarified in section 4.2. Yet, the relevant examples allow for conditional paraphrases, a fact which is potentially problematic for the mentioned approaches. One
could assume that P-imperatives are just conditional structures in disguise. One must then explain why the semantic relation between A and B does not coincide with that observed between the antecedent and consequent of conditional sentences. Alternatively, one could describe P-imperatives as ‘special’ conditionals, which, when compared to the standard ones, obey additional constraints. In that case, the question arises whether there is a connection of some kind between the imperative morphology and these specific constraints.

In this paper, we follow the second route and show that P-imperatives are special conditional structures that most probably inherit their semantic features from an interaction between modal subordination and the basic semantics of imperative. In section 2, we present the data we consider in the paper. In section 3, we focus on certain problematic observations, which are not accounted for by current analyses. In section 4, we characterise the semantic constraint we propose in Lewis’s counterfactual framework, motivating the pseudo-imperative construction in section 4.3. Finally, in section 5, we discuss briefly some aspects of the syntax-semantics interface.

## 2 Basic observations

In this section, we provide a short description of the relevant structures in English and in French. In addition to P-imperatives, one finds P-declaratives (2a-b), where A is a declarative clause, P-optatives in French (2-c) and P-interrogatives (2d-e), where the ũ marks rising intonation. We will be mostly concerned here with P-imperatives and P-declaratives.

(2) a. You come near (and) I show you
   b. Tu t’approches (et) je te montre
   c. Qu’il vienne et je lui montrerai
      that he come-SUBJ and I him show-FUT
   d. You have any problem (and) they come
   e. Tu as un problème (et) ils viennent

AB structures, where A is imperative and declarative, exist independently, without any conditional interpretation. They realize two speech acts, a command (advice, invitation) in A, followed by the expression in B of a consequence of the eventuality that A’s speech act targets, through modal subordination (Roberts, 1989). For instance, (3) might be interpreted as “I want you to come near. Then, I’ll show you”. It seems that the future is preferred, but the present tense is not impossible.

(3) (You) come near. I’ll show you

Several factors interact in facilitating or preventing a conditional interpretation for P-X (where X may be imperative, declarative, etc.). First, prosodic cues play a role in discourse attachment. Dargnat and Jayez (2008) show that, if a discourse segment A, occurring at the end of a sequence of segments Σ, is immediately followed by a segment B, the absence (or shortness) of pause between A and B and the presence of a continuative contour on A, favours a direct attachment of B to A, rather than to a previous
The nature of the discourse relation is largely unspecified. For instance, (4a) features a justification and (4b) a temporal relation. If, other things being equal, a conditional interpretation is possible, the combination of a short/null pause and a continuative rise favours the integration of A and B into a unique conditional discourse relation holding between A and B.

(4) a. Hurry up we are late
   b. Il est arrivé il était huit heures
      ‘He came it was eight’

Two remarks are necessary at this point. First, it is important to keep in mind that prosody does not create the possible discourse relation(s). It only makes the attachment of B to A most plausible and natural. The preferred attachment itself needs a discourse relation to gain substance. Therefore, the mentioned prosody-driven approach does not in itself account for P-X interpretations (where ‘X’ covers at least imperatives and declarative cases and possibly others). It would have this power only if one could show that, for instance, imperatives and declaratives can convey some hypothetical meaning by themselves. This is unlikely for imperatives\(^2\) and calls for further discussion in the case of declaratives. Second, from the fact that A and B can be connected by a discourse relation, it does not follow that the result forms a unique speech act. This might be the case for P-imperatives, as proposed by Franke (2008), but it is more debatable for examples such as (4) or (5) (Dargnat, 2008, ex. 10), where the question about the title remains separate and the global speech act, if any, does not consist in questioning the conditional relation.

(5) Tu écris tes mémoires, tu leur donnes quel titre?
   ‘You write your memoirs, what title do you choose?’
   ≈ If you write your memoirs, what title do you choose?

However, in all cases, prosodic cues favour an ‘integrated’ interpretation. Either there is a unique speech act or one of the acts is ‘focal’ or ‘foregrounded’, that is, it constitutes a potential answer to a question under discussion or introduces such a question. For example, in French, (4b) can be an answer to the question A quelle heure est-il arrivé? (‘When did he come?’) and (5) introduces a question about the title. We group these two possibilities (speech act merging and foregrounding) under the generic label of (discourse) integration.

A second type of factor is the semantic relation between A and B. In the most clear-cut cases, B expresses a consequence of A. Consequences can be divided into cases of triggering and generation. Intuitively, an eventuality \(e_1\) is a trigger of an eventuality \(e_2\) whenever \(e_1\) makes the occurrence of \(e_2\) more probable (or certain) according to general social, physical or logical laws. \(e_1\) generates \(e_2\) whenever the occurrence of \(e_1\) physically coincides with the occurrence of \(e_2\). For instance, one can open a door \((e_2)\) by turning the key into the keyhole \((e_1)\). Pollack (1986, 1990) distinguishes between generation and enablement: an action \(A_1\) enables \(A_2\) if \(A_1\) contributes to executing \(A_2\).

\(^1\)See (Mithun, 1988, p. 335) for a similar remark on the absence of an intonation break between conjoined clauses.

\(^2\)We disagree with Corminbœuf (2008) on this point.
but, in addition to executing $A_1$, it is necessary to do something else in order to achieve
the result of $A_2$. Note that (1) is a triggering case, not an enablement one. In addition
to the consequence vs. enablement distinction, one must consider the type of the terms
of the discourse relation, or in Sweetser’s (1990) terms the *domains* that are related. For
instance, in (5), one may discern a relation between the fact of writing one’s memoirs
(content domain) and the speaker’s question (speech act domain), which is prompted or
at least made relevant by the writing. A content-based relation between writing one’s
memoirs and choosing a title for them is also possible. As shown by Sweetser (1990)
and Dancygier (1998), there is a rich array of possibilities in *if*-conditionals. P-X are
more restricted. For instance Austinian conditionals, a.k.a biscuit-conditionals, are in-
felicitous with P-imperatives and P-optatives (6). The corresponding imperatives and
optatives are not impossible in P-X in general (7). These contrasts can be explained
by assuming that certain P-X require that there be a triggering or generation relation
(causation type) between the content of A and that of B (domain type). Franke (2008)
imposes an analogous constraint on P-imperatives. As shown by (7), P-imperatives and
P-optatives do not require that the A part describe an action.

(6) a. ?? Be hungry (and) there are biscuits in the cupboard
    b. ?? Qu’il ait faim (et) il y a des biscuits dans le buffet
       That he have-SUBJ hunger (and) there are biscuits in the cupboard

(7) a. Be hungry (and) you’ll realize how hard it is to control your bodily reactions
    b. Qu’il ait faim (et)
       il verra comme c’est dur de contrôler ses réactions corporelles
       ‘he’ll see how hard it is to control one’s bodily reactions’

A third family of parameters is the choice of tense and mood. We won’t go
into detail here, but we note that, in line with a similar observation by Culicover and
Jackendoff (1997), *and* is not compatible with a conditional interpretation when A is in
the conditional. So, *and* is not sufficient to determine a conditional interpretation.

(8) a. You’d come near, I’d show you (‘If you come near . . . ’)
    b. You’d come near and I’d show you (≠ ‘If you come near . . . ’)

3 The problem

In this section, we make clear what the relevant data are and why they are problem-
atic. In the literature on P-imperatives, one finds the view that they are not genuine
imperatives but rather elements of a conditional construction (van der Auwera, 1986;
Han, 1998; Takahashi, 2004; Russel, 2007; Franke, 2008). Whatever the details and the
differences between them, these proposals have two benefits. First, they provide a sim-
ple solution to van der Auwera’s asymmetry. van der Auwera (1986) observed that, in
families of example like (9), whereas the first three forms are appropriate in opposite
contexts, like cold/hot weather, the last one is more difficult to interpret in *both* contexts.
If one assumes that the *and* sentences are conditional structures in disguise whereas the
disjunctive structures associate two speech acts through modal subordination (‘Do that,
otherwise . . . ’), the first three sentences are predicted to be pragmatically appropriate. More importantly, the last one is predictably odd in both contexts since the two speech act interpretation is implausible and the conditional one is not available. A similar distribution exists for P-declaratives.

(9) a. Open the window and I’ll kill you [Context: it’s cold]
   b. Open the window or I’ll kill you [Context: it’s hot]
   c. Open the window and I’ll kiss you [Context: it’s hot]
   d. #Open the window or I’ll kiss you

Second, if A is hypothetical, we have an explanation of why it externally behaves as an NPI-licenser environment (Culicover, 1972).

(10) a. Make any serious attempt to understand string theory and it’ll ruin your scientific life
    b. Fais la moindre tentative sérieuse pour comprendre la théorie des cordes et ça ruinera ta vie scientifique

In view of its ability to account for two major observations, the conditional approach seems to be on the right track. However, there are some unexpected contrasts, which exhibit three features.

1. A conditional resultative interpretation is available. So, there is no question of a ‘hidden’ Austinian interpretation.
2. Only paratactic (= non-coordinated) P-declaratives are natural.
3. The contrast is unstable and seems to depend on the consequent.

Suppose for instance that the addressee has just bought a new computer and is very nervous about possible breakdowns. The speaker tries to make him relax by pointing out that he has signed in for a hot-line service. Although the four variants in (11) aim at conveying the very same conditional meaning (‘If you breakdown, you call the hot-line’), only the first is really natural.

(11) a. You break down, you call the hot-line
    b. #You break down and you call the hot-line
    c. #Break down, you call the hot-line
    d. #Break down and you call the hot-line

One might hypothesise that the ‘you call the hot-line’ actually carries a directive speech act, a fact which, for some reason, would hinder the interpretation of the last three examples. But the contrast persists with P-optatives, which pattern like P-imperatives.

(12) #Qu’il tombe en panne (et) il appelle la hot-line
    That he break down-SUBJ (and) he calls the hot-line

The contrast is also to be found with non-directive consequents. The directive interpretation may be absent from (13) if the speaker is taken to simply describe what is going to happen.

(13) a. You have a headache, I give you some aspirin
    b. #Have a headache (and) I give you some aspirin
    c. #You have a headache and I give you some aspirin
In the conditional paraphrases of (11) and (13), a result interpretation is available, since calling the hot-line (getting aspirin) results from breaking down (having a headache): ‘If you break down, then you call the hot-line’ (description), ‘If you break down, then you may/must call the hot-line’ (directive), ‘If you have a headache, then I give you some aspirin’.

The instability of the contrast is evidenced by (14). Suppose a context of car-pursuit, where a bunch of gangsters is running after the speaker and the driver, who is the addressee. (14c) extends the paradigm in the direction of (13).

(14) a. You break down (and) we are dead
b. Break down (and) we are dead
c. Have another fit (and) you are going to get an operation

At this point, the problem we face is the following. To what extent can we account for the observed contrasts without endangering the assimilation of P-imperatives and similar structures to integrated semantic objects, in which only one speech act is executed?

4 The automaticity condition

4.1 The basic automaticity constraint

The term ‘automaticity’ is reminiscent of Bolinger’s (1977) remark that in A and B P-imperatives, given A, B is ‘automatically’ true. A consonant suggestion has been made by von Fintel and Iatridou (2007) for Sufficiency Modal Constructions (SMC) of the general form ‘If you want to get A you only have to do B’. In essence, von Fintel and Iatridou propose that a SMC (i) presupposes that in every world where A obtains, the addressee does something and (ii) asserts that in at least one world where B obtains, the addresses does not do anything else than A. If we assume that P-imperatives correspond to SMC, we can account for (11c-d): there is no world reasonably similar to the actual world in which it is sufficient to break down to call the hot-line, since the call itself is a mandatory action, which is not triggered/generated by the breakdown independently of the agent (the addressee). The proposal has to be slightly relaxed, to allow for the possibility of (14)-type example. In the formulation given in (15), we leave open the possibility that a does or undergoes e.

(15) Given an agent a and a couple of eventualities e, e′, in which a participates, we say that e′ is an automatic consequence of e with respect to a, if e causes e′ and e′ is not an action by a.

In view of examples like (16), we do not need to describe a presupposed component. B reacts to A’s P-imperative by denying that breaking down would lead automatically to death. It is usually assumed that direct rejections (‘you are wrong’, ‘It’s false’, ‘You are lying’, etc.) cannot target the presupposed or implicated part of an assertion.3

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3Actually, this is not that simple. In some cases, one can construct natural examples where a discourse participant attacks a presupposition or a conventional implicature. However, in (16) and analogous examples, it seems difficult to find a presupposition or conventional implicature trigger and to articulate a main content fundamentally different from ‘B automatically follows from A’.
(16) A – Break down (and) we are dead  
    B – You’re wrong, we have guns, remember?

This shows that the constraint for P-imperatives must put the automaticity condition at 
the level of the main content. We treat P-optatives along the same lines since they pattern 
with P-imperatives. Only conjunctive P-declaratives must obey the same constraint.

(17) **Automaticity condition**

A P-imperative or P-optative of the form A (*and*) B is appropriate only under an 
interpretation where the eventuality described by B is an automatic consequence of 
the eventuality described by A with respect to the addressee. P-declaratives of the 
form A *and* B are subject to the same constraint.

Examples like (13) raise a problem, since having a headache might be a sufficient con-
dition for getting aspirin if the aspirin is provided by someone else than the relevant 
agent (by default, the addressee in P-imperatives). Although they may sound odd out 
of the blue, they improve in appropriate contexts. For instance, (13) fits well in a situa-
tion where the addressee is craving for aspirin. Generally speaking, communicating the 
fact that B is an automatic consequence of A makes better sense when automaticity is 
relevant to the addressee’s goals and concerns, that is, whenever comparing A to other 
non-automatic triggers of B or B to other non-automatic consequences of A can help 
the addressee to reach her goals or to update/revise her expectations, given her current 
concerns. When it is difficult to abduce plausible contexts for *using* constructions that 
convey automaticity, they will be felt as anomalous, even if is not difficult to abduce 
contexts that satisfy their basic semantic requirement, i.e. the automaticity condition. 
This is just one more illustration of the fact that the *Gedanke experiment* of interpreting 
sentences in isolation combines understanding the meaning of the sentences *and* moti-
vating their use. As an additional symptom of the difference, note that the following 
variant of (11) is perfect in a context where the addressee is seeking a reason for calling 
the hot-line.

(18) a. You break down (and) you can call the hot-line  
    b. Break down (and) you can call the hot-line

4.2 **A Lewis-style causal analysis**

So, pseudo-imperatives and coordinated P-declaratives demand that there be a causal 
relation between the eventualities described by A and by B. It is apparent from the dis-
cussion of causation type in section 2 that sufficient conditions correspond to triggering 
or generation, but never to enablement. At this stage, we have to make precise at least 
one notion of consequence, in order to provide a framework in which we can express the 
sufficiency requirement that characterises the pseudo-X we consider.

We resort to Lewis’s (1973a; 1973b; 2004) analysis of causation. Although some 
subtle aspects of causation might not be captured by Lewis’s approach (see the papers 
in Collins et al. (2004) for various illustrations), we consider that it covers all the main 
cases we need to take into account.
(19) Lewis’s causal dependency

1. For a given similarity ordering $\prec$ between worlds, $w, \prec| A \rightarrow B \equiv_{df}$ at every $w$-closest world where $A, B$

2. $B$ causally depends on $A$ at $w$ ($w, \prec| A \Rightarrow B \equiv_{df}$

$w$, $\prec| (A \rightarrow B & \neg A \rightarrow \neg B)$.

One must keep in mind that the intuition for ‘$A$ being a sufficient condition for $B$’ in a counterfactual analysis may convey a tension. On the one hand, to establish the truth of $A \rightarrow B$ at $w$, only the minimal revisions of $w$ with $A$ are considered. This entails that all that is necessary to derive $B$ from $A$ is already present in $w$ or is a consequence of adopting $A$ in $w$ and making as few changes as possible. In this respect, $A$ is ‘sufficient’ to ensure $B$. On the other hand, events posterior to $A$ in $w$ might play a role; so, in that respect, $A$ is not really ‘sufficient’ to trigger $B$. Consider (14): if an unfortunate breakdown occurs, the $B$ event (the murder) cannot take place if the gangsters change their plan for some reason and decide to abandon the pursuit. For $B$ to take place, an action by the gangsters is required, which means that the murder is not really ‘automatic’ in a strictly causal and deterministic sense. However, in the situation at hand, the murderous intentions of the gangsters are part of the initial conditions. Therefore, in order to obtain an acceptable definition for ‘$B$ is an automatic consequence of $A$ at $w$’, we need to make sure that (i) $A$ causes $B$, that (ii) no eventuality of $w$ posterior to or simultaneous with $A$ and which would not be caused only by eventualities preceding $A$ is necessary for obtaining $B$ and that (iii) actions of the relevant agent (e.g. the addressee for P-imperatives) may be suppressed without changing the result $B$.

We construct our definition for automaticity in two major steps. First, we define a notion of sufficient condition; then, we define automaticity proper. We abbreviate (19.2) as $A \Rightarrow_{w, \prec} B$. Worlds are seen as sets of eventualities. The set of worlds, $W$, contains every consistent subset of eventualities. In particular, if $w \in W$, $w' \subseteq w$ and $w'$ is consistent, $w' \in W$.

(20) For a set of eventualities $E$ in $w$, $\text{CAUSE}_{w, \prec}(E) = \{e \in w : \exists e' \in E(e' \Rightarrow_{w, \prec} e)\}$

$\text{CAUSE}_{w, \prec}(E)$ stands for the set of causes of eventualities in $E$. We can now ‘slice up’ worlds into temporal regions with respect to $A$. $X \prec_{w} Y$ notes that the starting point of $Y$ is posterior to that of $X$ in $w$.

(21) 1. $w_{\prec A} =_{df} \{e : A \leq_{w} e\}$

2. $w_{\prec A} = w_{\prec A} \cup \{e \in w : \text{CAUSE}_{w, \prec}(\{e\}) \subseteq w_{\prec A}\} \cup \{e \in w : \forall e'((e' \in \text{CAUSE}_{w, \prec}(\{e\}) & e' \geq_{w} A) \Rightarrow \exists e''(e'' \in \text{CAUSE}_{w, \prec}(\{e\}) & e'' <_{w} A)\}\}$

$w_{\prec A}$ is the set of eventualities that precede $A$. $w_{\prec A}$ is the set of eventualities that (i) precede $A$ or (ii) have at least one causal precursor that precedes $A$. The notion of sufficient condition (22) corresponds to a causal dependence between a precursor $A$ and a consequence $B$ where the world ordering is sensitive only to those eventualities that precede $A$ or have precursors that precede $A$.

(22) Let $W_{\prec A}$ be $\{w \in W : \exists w' \in W (w = w'_{\prec A})\}$. $A$ is a sufficient condition for $B$ at $(w, \prec)$ whenever $w_{\prec A}, \prec| W_{\prec A} \models A \rightarrow B$ and $w, \prec| \models \neg A \rightarrow \neg B$. 

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In prose, $A$ is a sufficient condition for $B$ at $w$ if, (i) when we compare only worlds where no eventuality not preceding $A$ or causally dependent only on eventualities not preceding $A$ takes place, at every closest world, if $A$ then $B$, and (ii) $\neg A \implies \neg B$ holds at $w$ in the original model $(W, \prec)$. In contrast with $A \Box \implies B$, we do not require that worlds be modified for $\neg A \Box \implies \neg B$. Consider the gangsters’ case. If the fugitives do not break down and the police has enough time to rescue them, we don’t want to suppress the rescuing event because it occurs after the breakdown, since doing so might falsify $\neg \text{breakdown} \Box \implies \neg \text{killing}$.

Under the simple deterministic view we have adopted, ‘$A$ is a sufficient condition of $B$’ means that the causal link from $A$ to $B$ does not involve any eventuality that would be independent of every event preceding $A$. In the gangsters’ case, given the initial setting (the physical circumstances and intentions of the agents) the killing is unavoidable once the breakdown has occurred. Thus, the breakdown is a sufficient condition of the killing since all the eventualities that have a part in the result are triggered or generated by eventualities that precede the breakdown. With (11), the breakdown is also a sufficient condition of the call if calling the hot-line is the consequence of a plan existing before the breakdown. In order to reflect von Fintel and Iatridou’s idea, we need an extra constraint in the definition of sufficient condition. If $a$ is the relevant agent, the general idea is to ‘ignore’ the actions of $a$ that do not precede $A$, even if they play a causal role in bringing about $B$ and are caused by eventualities that precede $A$. We define a new shrinking method, $w^{\alpha_a}_{\triangleleft A}$, which consists in subtracting from $w_{\triangleleft A}$ the actions by $a$ that do not precede $A$. $\alpha_x$ ranges over actions by $x$.

$$ (23) \quad w^{\alpha_a}_{\triangleleft A} = w_{\triangleleft A} - \{ \alpha_a : \alpha_a \geq w_{\triangleleft A} A \} $$

Finally, $A$ entails $B$ automatically if (i) $B$ causally depends on $A$ in a model where we keep only the worlds where eventualities irrelevant to the causal connection between $A$ and $B$ and actions not preceding $A$ have been suppressed and (ii) $\neg B$ causally depends on $\neg A$ in the initial model.

$$ (24) \quad \text{Automatic consequence} \quad B \text{ is an automatic consequence of } A \text{ in } w \text{ w.r.t. an agent } a \text{ whenever:} \quad w^{\alpha_a}_{\triangleleft A}, \prec \models W^{\alpha_a}_{\triangleleft A} \models A \Box \implies B \text{ and } w, \prec \models \neg A \Box \implies \neg B. $$

When applied to (11), (24) predicts that the action of calling the hot-line will be removed from any relevant world, which conflicts with the possibility of characterising the call as a consequence of the breakdown. The analysis offered here deliberately ignore the issue of causal preemption, that is, roughly speaking, the fact that several conflicting causes may produce the same effect. It does not seem to be crucial for the type of simple examples we have commented. However it is an open problem whether preemption can be accommodated in a counterfactual framework like Lewis’s (see Hall and Paul (2003); Spohn (2006)).

### 4.3 How come?

As noted in section 2, modal subordination plays a role in the conjunction of an imperative clause and a clause expressing one of its consequences (Jayez, 2002; Jayez and
Imperatives propose to or impose on the addressee a some course of action $\alpha$. If the result of $\alpha$ depends on further actions of $a$, they should be mentioned as recommended or compulsory. It would be uncooperative to mention only $\alpha$ and to count on some other action which does not necessarily follow from the context and is not a default action by the addressee. So, in general, in a structure $A$-IMP $B$, where $B$ expresses the result of $A$, this result is an automatic consequence. In such modally subordinated structures, automaticity is a conversational implicature. It is not infrequent to see pragmatically preferred interpretations of linguistic structures acquire a conventional meaning, although there is probably no agreement about what factors are (ir)relevant (frequency, saliency, etc.), as evidenced by the discussion in Ariel (2008, chap. 5). We conjecture that automaticity has become the prominent conventional meaning of $A$-IMP $B$ structures whenever prosody (short/null pause + continuative rise) favoured an integrative interpretation, as explained in section 2. In addition to this combination of a conditional reading (integration) with automaticity ("frozen pragmatics"), P-imperatives exhibit a sort of bleaching on the imperative itself. The $A$ part may use non-controlled predicates, as in (25).

(25) a. Be a blonde and every man will start fantasising about you
   b. #Be a blonde

What is the role of _and_? Normally, _and_ introduces the last term in an enumeration. So $A$ _and_ $B$ suggests that $B$ is the last term in a sequence of eventualities. Consider paratactic (= non-coordinated) P-declaratives $A$ _and_ $B$. The conditional interpretation corresponds to the view that the eventuality $e_A$ expressed by $A$ leads to a point where $e_B$ is normally true or bound to be true. But other eventualities might play a role. The relation between $e_A$ and $e_B$ may be paraphrased by ‘given $A$, normally $B$’, which means that, in certain cases, for $e_B$ to obtain, $e_A$ should be supplemented by other eventualities, which are expected to happen (‘normal’) in general or in the particular circumstances under consideration. With coordinated P-declaratives, $B$ is marked as final. Why would a speaker choose to emphasise that a result is final, rather than just a result? A plausible reason is that $e_A$ leads directly to the result ($e_B$), without it being necessary to mention any intervening eventuality. So, the speaker is convinced that, given $A$, the whole process will run to its term, this belief being itself motivated by the fact $e_A$ leads automatically to $e_B$ without any agent intervention (blind causality) or with respect to some agent, whose action is irrelevant to the result. We conjecture that the latter inferential motivation has been internalised as a grammatical construction, which would explain the difference between the paratactic and _and_-coordinated forms for P-declaratives.

### 5 Interface problems

In this section, we discuss briefly the representation of P-structures in an extension of the HPSG framework (Pollard and Sag, 1994), designed to accommodate _constructions_ in the sense of Goldberg. Strictly compositional structures preserve the contribution of their constituents in isolation. In P-structures, $A$ (_and_) $B$, $A$ has not the meaning it has

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4A term we borrow from Levinson (1987), see also Hyman (1984).
in isolation, e.g. imperatives are not semantically imperative. Moreover, the prosodic integration of A and B cannot be attributed to A or B separately. The rising contour itself seems to be ambiguous between continuation and interrogation (Dargnat and Jayez, 2008). This shows that P-structures should be analysed as constructions. It is well-known that Construction Grammars exploit feature structures of the type used in HPSG, in particular because they provide facilities for accessing different parts of information simultaneously (multidimensionality). The default mechanism of HPSG (Lascarides and Copestake, 1999) can also be imported. The following feature structure summarises the most important aspects of the representation for French. / notes a default value.

The decl-hd-su-cl type corresponds to declarative headed clauses with a subject and demands indicative or conditional mood. Imperative clauses demand imperative mood. The initial string X (et) Y is split into two constituents consA and consB. consA hosts preferentially a rising contour and is preferentially saturated (/{}). The pause is preferentially short or null. Two discourse moves A' and B' with a common speaker are associated with A and B. attach type objects describe the attachment of a discourse move to a subset (list) of discourse moves through a discourse relation (value of DR). B' must be attached to A' through an automatic consequence relation. ⇒ notes the replacement of a value. The original illocutionary force of A' is switched to a hypothetical value. The whole construction inherits its illocutionary force (assertion) from B'. The net result amounts to asserting the proposition (C) that an automatic consequence relation holds between a hypothetical discourse move (A') and an assertive discourse move (B') attached to it.

(I) decl-hd-su-cl: [HEAD [MOOD ind ∨ cond]]  (II) imp-hd-cl: [HEAD [MOOD imp]]

(III) P-imp/decl:

\[
\begin{array}{l}
\text{STRING} \quad (\mathfrak{I} : (et), \mathfrak{I}) \\
\text{CONSA} \quad \text{decl-hd-su-cl} \quad \text{imp-hd-cl} \\
\quad \text{MORPH} \quad \text{SLASH} \quad \text{END-CONTOUR} \quad \text{dmv} \\
\quad \text{PAUSE} \quad \text{l} \quad \text{(short ∨ null)} \\
\quad \text{CONSB} \quad \text{dmv} \\
\quad \text{DISC-MV} \quad \text{SPK} \quad \text{ILLOC-FORCE} \\
\quad \text{DISC-MV} \quad \text{list-of(disc-mv)} \\
\quad \text{CNTXT} \quad \text{DISC-RELS} \quad \text{list-of} \\
\quad \text{ATTACH} \quad \text{DR} \quad \text{DISCMV1} \quad \text{DISCMV2} \\
\quad \text{ATTACH} \quad \text{DR} \quad \text{DISCMV1} \quad \text{DISCMV2} \\
\end{array}
\]
This basic feature structure has to be supplemented with constraints that handle more specific details, such as the presence of *et* or mood/tense agreement. E.g., P-declaratives require the presence of *et* under the automatic consequence interpretation (1), when A is in the conditional, B also must be in the conditional (2), A may not be in the plus-que-parfait (≈ pluperfect) (3), etc., see Dargnat (2008) for other examples.

1. CONSA: decl-hd-su-cl ⇒ STRING: ⟨X. et. Y⟩
2. CONSA: HEAD\MOOD: cond ⇒ CONSB: HEAD\MOOD: cond
3. CONSA: TENSE: ¬plus-que-parfait

### 6 Conclusion

In further work, we will apply the present approach to a larger spectrum of paratactic structures, involving for instance optative and interrogative clauses as well as NPs (see Culicover’s (1972) OM-sentences). Ideally, the relationship between coordination and conditional interpretation would have to be studied in a broader typological and diachronic setting. In particular, the fact that *and* is semantically distinctive for P-declaratives should be compared with the idea that, typologically, conjunctive coordination is less marked than, for instance, disjunctive coordination (Ohori, 2004). While the contrast between *and* and *or* P-declaratives (one vs. two speech acts) goes in the same direction, the role of *and* in P-declaratives is, in this respect, in need of further clarification.

### References


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Focus Alternatives and Contextual Domain Restriction: A Visual World Eye-tracking Study on the Interpretation of ‘Only’

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Abstract
The interpretation of sentences with focus-sensitive elements like ‘only’ depends on context to restrict the domain of relevant alternatives for evaluating the focused expression. But what kinds of contextually available information do listeners actually use to restrict interpretive domains? Three visual world eye-tracking experiments show that listeners use at least previous mention (Experiment 1), real-world knowledge about specific scenarios (Experiment 2), and conceptual similarity to recently mentioned items (Experiment 3).

1 Introduction

The semantic contribution of the focus particle ‘only’ in sentences like (1-a)-(2-a) has two components, under standard assumptions: (i) the proposition expressed by the sentence without ‘only’—e.g., Matt’s acing the exam in (1-a); and (ii) the claim that no alternative to the focus value associated with ‘only’ makes the sentence true. The focus value and its alternatives are understood to be drawn from some appropriately restricted domain, as suggested in (1-b)-(2-b).

(1) a. Only Matt got a perfect score on the exam.  
   b. students in some class

1This proposition is often referred to as the prejacent; there has been a lot of debate about its status, which we do not address here.
(2) a. I only had a crush on Jared Leto.
b. cast of mid-90s teen TV drama ‘My So-called Life’

A likely context for (1-a), for instance, is a discussion of a specific class in a specific term. In other cases, like (2), the alternatives that the sentence is interpreted against seem to vary easily with the particular discourse context the sentence appears in.

Our concern in this paper is how this contextual narrowing of alternatives takes place. The work of spelling out the role of context generally falls to pragmatics, as von Fintel (1998) suggests in connection with similar issues of domain restriction for generalized quantifiers:

The idea is to (temporarily) restrict the domain of evaluation for the whole sentence or even the whole discourse. The pragmatics will help in choosing a suitable universe for the evaluation of a particular sentence, but the semantics can just operate abstracting away from any such choice of a universe.

Rooth (1996) similarly characterizes the domain variable posited for interpretation of focus as pragmatically determined. How exactly the pragmatics accomplishes the task of suitably restricting the domain remains largely unarticulated. Our approach in the present study is to investigate experimentally potential sources of relevant contextual information by considering their effects on processing of sentences with ‘only’.

We examine three factors, starting with preceding mention, cited by Rooth (1996) as one pragmatic factor affecting interpretation of ‘only’ sentences. With reference to (3) (Rooth’s 24), he observes that “the domain of quantification is understood as consisting of just three propositions, rather than the full set of propositions of the form ‘John introduced y to Sue’ ”.

(3) John brought Tom, Bill, and Harry to the party, but he only introduced Bill to Sue. *(Rooth 1996, example 24)*

That is, the domain is restricted to the set of propositions featuring the individuals just mentioned. In Experiment 1, we manipulate the factor of previous mention, as in Rooth’s example.

Experiment 2 varies, in addition to linguistic mention, ‘how much’ context there is—that is, how much the nature of the scene described by the context-setting sentences constrains likely alternatives. To illustrate this, consider a shopper described as being at a farmers market vs. one who is at a shopping mall. Potential purchases for the first shopper are most likely confined to produce and other food items, whereas the mall shopper could be buying just about anything. Relative to the shopping mall, the farmers market context is more restrictive and hence more informative, in a sense, about the kinds of things available for purchase.

Finally, Experiment 3 introduces the factor of conceptual similarity with previously mentioned items. In principle, the pair of sentences (4-a)-(4-b) can be interpreted with respect to the alternatives in (4-c), but we most easily construe this as meaning ‘strawberries, but not other types of fruit’ (4-d).
Focus Alternatives and Domain Restriction: Interpreting ‘Only’ in Context

The remainder of this paper is structured as follows. First, in Section 1, we review some relevant previous psycholinguistic work on domain restriction. Section 2 introduces the Visual World paradigm in general, and describes specifically how eye movements can be used to probe comprehenders’ expectations about focus alternatives. Sections 3-5 present three eye-tracking experiments examining effects on focus alternatives of previous mention, informativity of the context, and conceptual similarity, respectively. Section 6 concludes with directions for future research.

2 Using eye-tracking to investigate domain restriction

Our methodology involves monitoring of participants’ eye movements in a ‘visual world’ paradigm. In a typical visual world eye-tracking study, participants move or click on objects in a visual display as they are listening to a sentence that indicates what item in the display is the target. Eye-movements have been shown to be closely time-locked to salient linguistic events in auditorily presented stimuli (Tanenhaus et al., 1995), and therefore provide a means to track listeners’ expectations about upcoming linguistic input given the visual context and what they have heard so far. By manipulating the availability of different information types available in the visual or linguistic context, one can ask to what extent each of these potential information sources helps the listener restrict the referential domain to the point that the single intended referent can be picked out.

Previous experimental work has shown that language comprehenders rapidly integrate multiple sources of information for the purpose of referential disambiguation. Tanenhaus et al. (1995) showed that reference resolution can be guided by what we know about the meanings of definite descriptions, in conjunction with properties of the visual context. Participants’ eye movements were tracked as they followed instructions to manipulate items in a display. For example, they would hear ‘Put the apple on the napkin in the box’, while viewing a display containing one apple on a napkin, an empty napkin, an unrelated item, and a box. They found that whether the PP ‘on the napkin’ was interpreted as a modifier or as a goal depended on properties of the visual display. When the display contained only one referent that matched the description ‘apple’, at the point when participants had heard ‘the apple’, they had all the information they needed to pick out the intended unique referent in the scene. As a result, ‘on the napkin’ was not construed as a modifier but as a goal: participants looked at the empty napkin and sometimes even started to put the apple on the empty napkin. However in a display containing two apples, after hearing ‘Put the apple’, listeners interpreted ‘on the napkin’ as a restrictive modifier picking out one of the two apples, not a goal.

These findings demonstrate that reference resolution is an incremental process that is sensitive to the visual context—in fact small changes to the visual context can bias comprehenders in favor of one parse over another. Moment to moment biases are reflected in participants’ anticipatory eye movements as they are interpreting a sentence

(4) a. Jill likes apples and nectarines.
   b. Abby only likes [strawberries].
   c. {strawberries, apples, nectarines, grapes, peas, socks, fountain pens,...}
   d. {strawberries, apples, nectarines, grapes,...}
in a particular visual context. Subsequent studies have established language comprehenders’ sensitivity to a variety of information sources during online processing: selectional properties of lexical items (Altmann & Kamide, 1999), the presence of contrast (Sedivy et al., 1999), information about the preceding linguistic discourse (Chambers et al., 2002), and knowledge about possible eventualities in the world (Chambers et al., 2004).

The current study take the same methodological approach to investigating what factors determine what is included in the set of focus alternatives that a sentence like (5) is interpreted with respect to.

(5) Jane only has some candy.

Under our standard assumptions, (5) conveys that Jane has some candy and that she has nothing other than candy. What is included in this ‘nothing else’? Since the eventual target word (‘candy’) must be included among the focus values, having an expectation about what that word will be amounts to having stronger or weaker expectations about what will be a possible alternative.

For each trial, we record continuously what item the participant is fixating in a display like Fig. 1, as they are hearing the target sentence. After averaging this information over many trials (for a number of subjects), we can look at the proportion of fixations to a particular display item (for example, fixations to the target item) over time. Once we have the proportion of fixations to the target, the cohort competitor, and the distractors, we can look at a particular time interval and ask whether there is a difference between the proportion of looks to each display item.

3 Experiment 1: Focus alternatives are constrained by previous mention

Even out of the blue, one might expect (5) to be interpreted with respect to just the relevant alternatives (6-a).

(6) a. \{candy, cupcakes, apples, sandwiches, gum, dry erase markers, refrigerators, pickup trucks ...\}

\(^2\)The cohort competitor shares initial phonology with the target word; see Section 3.1.
b. \{\textit{candy, cupcakes, apples, sandwiches, gum, ...}\}

(7) Mark has some candy and some apples.

But in the context of a sentence like (7), the mentioned subset of the focus alternatives seem much more salient (6-b): the mentioned alternatives are somehow ‘preferred’. Is the set of alternatives considered in interpreting a sentence like (5) constrained by the set of things just mentioned in the discourse?

### 3.1 Design, Procedure

The same basic paradigm is used (with variations) in all four experiments. The pre-recorded stimuli each consist of one or more context sentences, the last one of which includes references to particular types of objects such as boots or candy. The target sentence follows, as exemplified in (8).

(8) a. \[(\text{Context})\] Mark has some candy and some apples.

b. \[(\text{Target})\] Jane (only) has some . . .

(i) candy

(ii) candles

What Jane is described as having varies by experimental condition, e.g., the mentioned candy above vs. unmentioned pencils. The presence vs. absence of only is systematically varied as well. The task required of subjects is simply to click on the item(s) identified in the target sentence.

We manipulated (i) whether the target word was mentioned in the context sentence (Mention), and (ii) whether ‘only’ appears in the target sentence. Examples of the four resulting conditions are in Table 1; target sentences are to be interpreted with respect to the four-item display in Fig. 1.

On each trial, participants heard a pair of sentences like (7) (context sentence) and (5) (target sentence). At the onset of the target sentence, four pictures appeared (Fig. 1), one in each quadrant of the computer screen. Participants were instructed to click on the items in the target sentence (i.e. the things Jane had). 28 University of Rochester students who were native speakers of American English participated in the experiment.

<table>
<thead>
<tr>
<th>Context</th>
<th>No Mention</th>
<th>Mention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mark has...</td>
<td>...some gloves and some pencils.</td>
<td>...some candy and some pencils.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Target</th>
<th>No Only</th>
<th>Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jane...</td>
<td>...has some candy.</td>
<td>...only has some candy.</td>
</tr>
</tbody>
</table>

Table 1: Experiment 1 design and example stimuli.

In experimental trials, two of the four pictures were members of the same phonological cohort (‘candy’-‘candles’). In the absence of biasing factors, participants will begin to shift fixation to words that match the acoustic input about 200 ms after the onset
of the word (Allopenna et al., 1998). Therefore we expect participants to look equiprobably at the target item and the cohort competitor at the point in the target sentence when they’ve heard just the beginning of the direct object (‘can... ’). As the unfolding auditory input disambiguates the target referent (‘...ndy’) — the point of disambiguation — the proportion of fixations to the target item should rise as fixations to the competitor drop off. This means that if looks to the target item increase earlier than the point of disambiguation, there is a bias toward the target item due to some other property of the stimulus.

If recent mention of a particular type of object makes that kind of object more salient, as seems plausible, then we expect earlier identification of the target candy just in the Mention conditions. Since the target item in critical trials is always either an item mentioned in the Context sentence, or a phonological competitor of a mentioned item, using previous mention as a cue would effectively allow participants to identify the target early, despite the fact that the initial syllables of the target and competitor are identical.

Whether the presence of ‘only’ by itself can be expected to facilitate identification of the target is not clear. A more interesting question is whether ‘only’ interacts with the mention factor. If the presence of ‘only’ strengthens the mention effect, we will see fastest identification of the target in Mention Only conditions — faster than can be expected on the basis of Mention NoOnly and NoMention Only conditions.

### 3.2 Results

In order to examine the time course of fixations, we calculated the proportion of fixations to the target at every 33 ms time slice, aggregating trials for each condition first within a participant and then across participants. Fig. 2.a shows proportion of fixation curves plotted as a function of time. The average time to convergence on the target referent (where target looks reliably exceed looks to the competitor) for each condition is shown in Fig. 2.b. For example, the ‘Mention-Only’ curve in Fig. 2.a corresponds to the average proportion of looks to the quadrant containing the target referent, candy, in Fig. 1, as listeners hear the sentence ‘Jane only has some candy’. In this condition, the target word will have been mentioned in the preceding context sentence. The corresponding bar in Fig. 2.b (rightmost) represents the average time for fixations to converge on candy—that is, diverge from fixations to the competitor, candles.

There were main effects of Mention ($F_{(1, 24)} = 46.8, p < .0001$) and Only ($F_{(1, 24)} = 6.2, p < .05$), as well as a Mention-Only interaction ($F_{(1, 24)} = 14.8, p < .0005$). On No Mention trials, listeners were able to disambiguate the target referent from the phonological competitor only after hearing the entire word, on average 560 ms after the onset of the target word (left-hand bars in Fig. 2.b). Thus in the absence of Mention, listeners had no preference for candy over candles. There was no advantage for the Only condition over the No Only condition ($t = 1.4, p = .15$).

The Mention-No Only trials (right-hand bars, Fig. 2.b) showed an effect of Mention independent of any effect of Only: fixations converged on the target referent 404 ms after target word onset. Thus when a previously mentioned item appeared as part of the visual context, listeners had a preference for the mentioned item. When ‘only’ was present, fixations converged on the target referent 139 ms after target word onset, well
Figure 2: Experiment 1: a. Proportion target fixations over time, b. Mean point of disambiguation (error bars are Standard Error).
before the input disambiguated the target and the cohort competitor. In the 200-400 ms post-target onset interval, fixations to the target in Mention-Only trials exceeded those in Mention-No Only trials ($t = 10.4, p < .001$), while No Mention trials did not differ as a function of Only ($t = .9, p = .35$). Thus, after hearing only the initial part of the target word, listeners strongly expected the possible referents to be constrained by the set of just mentioned items. When this expectation is violated, as in the No Mention-Only condition, the point of disambiguation is late (in fact, later in absolute terms than in the No Mention-No Only condition).

These results suggest that upon hearing ‘only’, listeners have a strong expectation that the upcoming focus will be a recently mentioned item. We might think of ‘only’ as functioning as a cue that increases listeners’ sensitivity to aspects of the preceding discourse context.

4 Experiment 2: Informativity contributes to restricting alternatives

Presumably the manipulation of Mention in Experiment 1 has the effect of making some set of things salient in the context. We might then expect to observe the same restrictive effect just by enriching the information in the context (i.e. making the context more ‘restrictive’). Experiment 2 tests this hypothesis, asking whether having richer information in the context contributes to restricting focus alternatives in sentences like (9). Compare (10-a) and (10-b).

(9) Peter only wants to buy [some magazines].

(10) a. Jill and Peter are at the drugstore.
    b. Jill and Peter are at the newsstand.

Intuitively, (10-b) provides more information, since our knowledge about the world tells us that the range of items that can be purchased is relatively narrow compared to a drugstore, where a wider set of items can be purchased. In addition to repeating the experimental conditions from Experiment 1 (Mention x Only), Experiment 2 varied the informativity of the discourse context.

4.1 Design, Procedure

Experiment 2 crossed three factors: Context Informativity (Informative, Underinformative), Mention, and Only; the resulting eight conditions are given in Table 2. The corresponding visual display is in Fig. 3.

The procedure was as in Experiment 1, except that two context sentences (Context 1 and 2 in Table 2) preceded the target sentences. As participants heard the target sentence, they were shown a visual display like Fig. 3, with a target item (magazines), a cohort competitor (magnets), and two unrelated distractor items (scissors, lamps). Notice these are all items consistent with the Underinformative Context (here, ‘drugstore’),
## 4.2 Results

Fig. 4 shows the average time to convergence on the target referent (Underinformative conditions on the left, Informative conditions on the right).

### 4.2.1 Underinformative contexts

There were main effects of Informativity ($F(1, 20) = 34.0, p < .0001$), Mention ($F(1, 20) = 11.5, p < .001$), and Only ($F(1, 20) = 9.8, p < .005$), and no interactions.

Underinformative contexts patterned much like Experiment 1. This is expected: the most underinformative thing to say is nothing at all, and in this case the four Underinformative conditions reduce to the conditions in Experiment 1. The target referent was disambiguated latest in the No Mention-No Only and Mention-No Only conditions.
earlier in the No Mention-Only condition, and earliest in the Mention-Only condition (Fig. 4, left-hand bars). As in Experiment 1, ‘only’ seems to increase sensitivity to information in the preceding linguistic context, creating a bias in favor of discourse-old items.

### 4.2.2 Informative contexts

First, there was a general restrictive effect of context informativity: Informative context conditions had on average a 335 ms earlier convergence on the target referent relative to the corresponding Underinformative context conditions.

In addition, the benefit due to informativity was strengthened in the presence of ‘only’: there was a 399 ms advantage due to Informative context in Only conditions, compared to a 271 ms advantage for No Only conditions. In Mention-Only trials, target fixations start rising well before the onset of the target word, soon after the onset of ‘only’. The largest advantage occurred in the Mention-Only condition, where listeners were able to disambiguate the target referent after hearing ‘only’, but well before the onset of the target word.

### 5 Experiment 3: Generating expectations about likely alternatives

In Experiment 3, we asked whether conceptually similar alternatives are preferred over conceptually unrelated ones: after hearing ‘Jane likes apples and nectarines’, a continuation like ‘Mark only likes oranges’ seems more expected than one like ‘Mark only likes pickup trucks’. If this contrast is real, we might be able to use it to ask a question about
the nature of the expectations comprehenders have about the members of the alternative set.

What might listeners be doing to produce the results of Experiments 1-2? At least two explanations seem possible. First, maybe given the items in the visual display, listeners are ruling out certain referents as unlikely (based on the previous discourse context, etc.). This could explain the pattern of results we observe in both experiments. But another possibility is that listeners use the information from the discourse context to start generating hypotheses about what items are likely to be in the alternative set. If listeners are actively generating candidate alternatives, they might do this on the basis of something like conceptual similarity; this would predict earlier target disambiguation for same-category over different-category items, even without previous mention.

5.1 Design, Procedure

The structure of Experiment 3 is virtually identical to Experiment 1. Participants heard sequences consisting of a context sentence and a target sentence (Table 3; the corresponding visual display is shown in Fig. 5).

<table>
<thead>
<tr>
<th>Context</th>
<th>Mention</th>
<th>Novel-Same category</th>
<th>Novel-Different cat.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mark has...</td>
<td>...some apples and oranges.</td>
<td>...some pears and some oranges.</td>
<td>...some boots and some sandals.</td>
</tr>
<tr>
<td>Target</td>
<td>Jane only has some apples.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Experiment 3 design and example stimuli.

At the onset of the target sentence, a display containing a target item (apples), a cohort competitor (anchors), and two unrelated distractors (candycanes, speakers) appeared. Based on Experiments 1-2, we expect a Mention preference. The question of interest is whether there is an advantage for Same-category over Different-category Novel items. 16 native English speakers participated in the experiment.

5.2 Results

Average points of disambiguation are in Fig. 6. Fixations converged on the target referent earlier in the Mention condition than in the Novel conditions ($t = 3.7, p < .0001$),
consistent with the results of Experiments 1-2.

Interestingly, within Novel conditions, the target was disambiguated earlier when the target word was in the same category as recently mentioned items (‘some pears and some oranges ... some apples’) than when it was in a different category (‘some boots and some sandals ... some apples’) ($t = 2.4, p < .05$). This advantage cannot be due to explicit mention, since Same and Different category conditions both contained novel target words. Instead, it suggests that previous mention of ‘pears’ and ‘oranges’ activates not only the meanings of those particular words and their corresponding conceptual representations, but also the conceptual category they are members of; this in turn makes other category members (like ‘apples’) more salient as possible members of the alternative set.

6 General discussion

In the current study, we address the question of how alternative sets are established for the purpose of interpreting sentences containing focus operators, looking specifically at sentences with adverbial ‘only’. We use comprehenders’ eye movements in a visual scene as a measure of their changing expectations about possible referents; in critical cases, the presence of ‘only’ earlier in the sentence served as a cue to attend to aspects of the linguistic context.

In three eye-tracking experiments, we show that recent mention (Experiment 1), the informativity of the linguistic context (Experiment 2), and conceptual similarity (Experiment 3) are among the factors that contribute to the restriction of focus alternatives in the context of ‘only’. These factors speed recognition of targets for sentences without ‘only’ as well, suggesting they have a general role in comprehension. Their enhanced effect in the presence of ‘only’ is striking, raising the possibility that ‘only’ has a general function of directing attention to contextual cues about the relevant domain for inter-
Interpretation. The results of Experiment 3 further suggest that listeners’ expectations about likely alternatives underly the contrasts observed in Experiments 1-2: given the linguistic context, comprehenders immediately begin generating hypotheses about likely focus alternatives.

These findings for ‘only’ raise interesting questions about the behavior of other focus operators. Future work comparing ‘only’ with other alternative-sensitive operators like ‘also’ will help pull apart the specific contributions of these lexical items from general aspects of focus interpretation. In particular, our conclusions about ‘only’ lead us to specific predictions about how the behavior of ‘also’ will diverge from ‘only’, allowing us to substantiate the hypothesis that comprehenders actively generate candidate alternatives. Even more generally, we have been treating focus alternatives as analogous to quantifier domains, but whether the same factors influence domain restriction is an empirical question. We anticipate addressing this question by comparing ‘only’ with quantifiers like ‘every’ or quantificational adverbs like ‘always’, which share with ‘only’ the general problem of domain restriction, but also differ along other dimensions (for instance, the presuppositions carried by an ‘only’ sentence versus an ‘every’ sentence) that may influence the types of information comprehenders take into consideration.

A very general problem to be addressed from the point of understanding language comprehension has to do with cue combination; that is, how do prosody, discourse parallelism, discourse old-new status, and other potentially relevant factors combine with each other? Once we can adequately characterize how different kinds of information interact in various instances of contextual domain restriction, we will be in a position to ask how the linguistic properties of particular lexical items predict what contextual information they will draw on, given general facts about how different information types are integrated during interpretation.

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References


Norm-Relatedness in Degree Constructions

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Abstract
We consider the distribution of norm-related readings with dimensional adjectives across various degree construction in Russian and English and argue that the observed pattern as well as some well-known asymmetries in the use of antonyms in English follow from the assumption that gradable adjectives are ambiguous between the scalar and the vague predicate meaning.

1 Introduction

Bierwisch (1989) introduced the term norm-relatedness to refer to the comparison with a contextually determined standard of the relevant gradable property. This kind of comparison is inherent in positive sentences like (1a) where Jimmy’s height is said to lie above the given standard of tallness. It is not obligatory in comparatives like (1b) that normally express direct comparison between two points referred to in the sentence.

(1) a. Jimmy is tall.
   b. Tony is taller than Jimmy.

Kennedy (2001) observes that the norm-related comparison in contrast to the direct comparison is a freely available interpretative option and surfaces as the comparison of deviation reading. Bierwisch also concludes that comparison with the norm can be part of the meaning of any degree construction and under certain circumstances it must be. In the latter account, norm-relatedness is treated as a re-interpretation strategy applied in the environments in which the direct comparison reading is impossible, e.g. a cross-polar anomaly example in (2) can only receive a norm-related interpretation.

(2) ??Tony is taller than Gemma is short.
    ‘Tony is further above the standard of tallness than Gemma is below the standard of shortness.’
Recently, Rett (2008) investigated the link between norm-relatedness and the polarity of the gradable predicate. In the equative, negative polar adjectives (A–) obligatorily trigger the norm-related reading, see (3a), whereas positive polar ones (A+) do not, see (3b). However, from a broader cross-linguistic perspective, the two phenomena are not always related. In Russian, the equative as well as some other degree constructions are norm-related regardless of the polarity of the adjective, compare (3b) and (4).

(3) a. Gemma is as short as Judy.
   b. Tony is as tall as Pat.

(4) Катя такая же высокая, как и Лариса.
   ‘Katja and Larissa are equally tall.’

It is this distribution of norm-relatedness in English and Russian that we will consider in this study. Our findings will reveal some crucial properties of degree constructions in these languages that may shed light on the long-standing puzzles related to the semantics of antonyms and measurement.

The paper is structured as follows: section 2 compares the norm-relatedness patterns in English and Russian and elaborates on the norm-related reading in English to highlight the link between the polarity and norm-relatedness; section 3 compares different approaches to norm-relatedness and sets the stage for the new proposal that is presented in section 4; in section 5 we discuss the consequences and conclude.

## 2 Data

### 2.1 Two Patterns of Norm-Relatedness

According to Rett (2008), who adopts a degree-based approach to the semantics of gradation, the cancellability of norm-related inferences in English, except in the positive construction (1a), depends on the polarity of the adjective and the properties of the involved degree operator. She observes that along with the equative, that we considered above, ‘how’ questions are norm-related too if they feature an A–. For example, the answer to (5a) must make reference to the narrowness norm for desks in the given context, while (5b) is normally a neutral request for the width of the desk.

(5) a. How narrow is the desk?
   b. How wide is the desk?

Comparatives, including the ‘too’ and ‘enough’ constructions, do not usually display such a switch in the meaning if the polarity of the predicate is reversed. However, as

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1 Rett uses the term evaluativity that is also employed to refer to the properties of non-dimensional adjectives, such as ‘happy’. We stick to Bierwish’s norm-relatedness to avoid confusion.
observed by Bierwisch (1989) for German in certain subdeletion comparatives only the
norm-related reading is available. If the embedded clause of a subdeletion comparative
contains an A−, the direct comparison is impossible, regardless of what is in the main
clause, see (6a–b). The A− in the subdeletion equatives, be it in the main or in the em-
bedded clause, forces a norm-related interpretation, see (6c–d). The complete pattern is
summarised in the table in (6) where the shaded cells represent the unavailability of the
direct comparison. According to Bierwisch, if the insertion of a differential measure
phrase or a ratio modifier makes a sentence unacceptable, the direct comparison read-
ing is not available and the sentence gets a norm-related interpretation, as illustrated in
(6). Note that Bierwisch’s measure phrase test is effective for degree questions as well.
If (5a) were not norm-related, (7) would be an acceptable answer to it.

(6) a. ??The door is (*2 cm) higher than it is narrow.
   b. ?The door is (*2 cm) lower than it is narrow.
   c. ?The door is (*twice) as high as it is narrow.
   d. The door is (*twice) as low as it is narrow.
   e. ?The door is (*twice) as low as it is wide.

<table>
<thead>
<tr>
<th>A+</th>
<th>A+ as A+</th>
</tr>
</thead>
<tbody>
<tr>
<td>A−</td>
<td>A− as A−</td>
</tr>
</tbody>
</table>

(7) *The desk is 70 cm narrow.

In Russian, we observe a contrast between the synthetic and the analytical form of the
comparative (also reported in Pancheva (2006) among others). The analytical compara-
tive is judged unacceptable in contexts containing the negation of the positive form of
the relevant adjective or its antonym, compare (8a) and (8b). Thus, Russian has a dif-
ferent distribution of norm-relatedness: the comparative morpheme on a gradable ad-
djective makes the norm-related inference cancellable. The equatives, too/enough compa-
ratives and superlatives support the observation that the norm related interpretation
in Russian is triggered by the lack of degree morphology on an adjective, see (9)–(12).

(8) a. Катя не высокая, но она выше, чем Сергей.
   Katja neg tall but she tall-er than Sergej
   ‘Katja is not tall, but she is taller than Sergej.’

b. Катя не высокая, *но она более высокая, чем Сергей.
   Katja neg tall but she more tall than Sergej
   ‘Katja is not tall, but she is taller than Sergej.’

(9) a. * Катя низкая, она такая/настолько же высокая,
   Katja short she that/by that much emph. tall
   как/насколько и Лариса.
   as/by how much also Larissa
   lit.: ‘Katja is short, she is as tall as Larissa.’

b. * Катя высокая, она такая/настолько же низкая,
   Katja tall she that/by that much emph. short
   как/насколько и Лариса.
   as/by how much also Larissa
   lit.: ‘Katja is tall, she is as short as Larissa.’
(10) a. ?? Катя низкая, но достаточно высокая, Katja short but enough tall чтобы дотянуться до полки. to reach to shelf lit.: ‘Katja is short but she is tall enough to reach the shelf.’

b. ?? Катя высокая, но достаточно низкая, Katja tall but enough short чтобы носить это платье. to wear this dress lit.: ‘Katja is tall but she is short enough to wear this dress.’

(11) a. ?? Катя низкая, но слишком высокая, Katja short but too tall чтобы уместиться на диване. to fit on sofa lit.: ‘Katja is short but she is too tall to fit on the sofa.’

b. ?? Катя высокая, но слишком низкая, Katja tall but too short чтобы носить это платье. to wear this dress lit.: ‘Katja is tall but she is too short to wear this dress.’

(12) a. ?? Все три брата низкие. all three brothers short Коля самый высокий из них. Kolja most tall from them lit.: ‘The three brothers are short. Kolja is the tallest among them.’

b. ?? Все три брата высокие. all three brothers tall Коля самый низкий из них. Kolja most short from them lit.: ‘The three brothers are tall. Kolja is the shortest among them.’

(13) a. Насколько стол широкий? by how much desk wide

b. Насколько стол узкий? by how much desk narrow

lit.: ‘How wide/narrow is the desk?’

The degree questions in (13) require a norm-related proposition as an answer, similarly to (5a). Neither (13b) nor (13a) can be used as a request for the width of the desk, they rather inquire about the comparison class or the relation to the contextual norm. Thus, an appropriate answer to (13a) would be ‘It is fairly wide’ or ‘It is wide for the desks in our department.’
Considering what we saw above, subdeletion examples that contain a morphologically unmarked form of the adjective in the embedded clause are expected to express comparison of deviation only. Indeed, the subdeletion equative in (14) does not compare the width and the length of the bed directly. It can be true if the bed is longer than it is wide, but, say, looks out of place due to its extreme wideness rather than its length.

(14) Эта кровать не настолько длинная, this bed neg by that much long
нисколько широкая.
by how much wide
‘This bed is not as long as it is wide.’

In compliance with Bierwisch’s test, measure phrases can occur only in the synthetic comparative in Russian since it does not require the norm-related interpretation in contrast to the analytical comparative, compare (15a) and (15b). Bierwisch’s test also correctly rules out the cases of the measure phrase modification of non-comparative adjectives in Russian, see (16).

(15) a. Кровать на 4 см/ в 2 раза шире, чем диван.
bed by 4 cm twice wide-ER than sofa
‘The bed is 4 cm wider than the sofa./The bed is twice as wide as the sofa.’

b. * Кровать на 4 см/ в 2 раза более широкая, чем диван.
bed by 4 cm twice more wide than sofa

(16) Кровать 80 см *широкая/ *узкая/ шириной.
bed 80 cm wide narrow width-instr
‘The bed is 80 cm wide.’

To conclude, two factors are responsible for whether a degree construction has a direct comparison interpretation or must be re-interpreted and make reference to the relevant contextual norm. First, in English, this is partly determined by the polarity of the predicate. In comparatives the overt instances of A\(\) in the embedded clause trigger re-interpretation. In the equatives the direct comparison is incompatible with the overt A\(\) in general. A\(\) in the ‘how’ questions also lead to norm-related readings. The second factor is at work in Russian where the norm-related interpretation is triggered by the lack of degree morphology on an adjective.

2.2 Norm-Relatedness and Antonymy

The constructions that we discussed in the previous section in connection with the norm-relatedness in English are often argued to show that A\(\) are marked with respect to their A\(+\) counterparts. Measure phrase constructions, ‘how’ questions, equatives with ratio modifiers and embedded clauses of subdeletion comparatives are the environments in which A\(+\) and A\(\) show a different behaviour. In these cases negative po-
lar adjectives result in deviancy, see (17a) and (17c), unless the sentences can receive a norm-related interpretation as in (17b) and (17d).

(17)  
   a. The desk is 70 cm wide/*narrow.
   b. How wide/narrow is the desk?
   c. The desk is twice as wide/*narrow as the doorway.
   d. The doorway is higher/lower than the desk is wide/??narrow.

Rullmann (1995) notes that this asymmetry is hard to explain in a degree-based theory if one makes the common sense assumption that the degrees of an A– are identical to the degrees of its antonymous A+. Since degrees are standardly defined as equivalence classes of individuals, see Cresswell (1976), the equivalence of antonymous degrees means that they refer to the same equivalence classes. This assumption is crucial for deriving the equivalence in (18), which Rullmann speaks of as the minimal adequacy requirement for any theory of antonymy.

(18) Katja is taller than Larissa. ⇔ Larissa is shorter than Katja.

The task of deriving (18) while accounting for the markedness of A– demonstrated in (17) drove Kennedy (1997) to introduce a sortal distinction between the two types of degrees. He suggests that antonymous degrees (extents) refer to different segments of the same scale. An A+ maps an entity to an initial interval on the relevant scale called the positive extent. The corresponding A– returns the final interval whose lower bound is shared by the positive extent. By adopting this distinction one can indeed come up with satisfactory explanations for the restricted distribution of A–, see Kennedy (2001), von Stechow (1984a). However, this kind of approach faces difficulties with the cases where one cannot appeal to the asymmetry of the poles on the one hand, see (19), and where this asymmetry does not lead to unacceptability on the other, see (20).

(19)  
   a. The desk is (*4 cm) lower than it is narrow.
   b. The desk is as narrow as the doorway.
   c. How narrow is the desk?

(20) The doorway is lower than the desk is wide.

By denying any link between polarity and norm-relatedness, extent-based theories fail to predict that (19a)–(19c) are impossible on the direct comparison interpretation and that the differential measure phrases are bad in subdeletion comparatives like (19a). Those analyses therefore have to resort to ad hoc stipulations to account for the norm-related inference, see Kennedy (2001, pp. 44–51). No less stipulatory are the existing explanations of the cross-polar nomaly in (20), see Büring (2007), Heim (2008).

We suggest a switch in the perspective in the hope of getting around some loose ends: we claim that the restricted distribution of A– is due to the norm-related inference. Before discussing this claim in more detail, let us consider the different approaches to analysing norm-relatedness.
3 Sources of Norm-Relatedness

Depending on the ontological assumptions, we can distinguish two approaches to analysing norm-relatedness. To derive the meaning of (1a), scalar theories usually need to assume a silent operator that performs the comparison to the contextual standard in the form of a free variable over degrees, von Stechow (1984b). In the “vague predicate” theories norm-relatedness stems from the meaning of gradable adjectives, Klein (1980). In this section, we will consider the two strategies and see that both have difficulties accounting for the data that we discussed above. Section 4 will be a synthesis of the two points of view.

3.1 Vague Predicates

According to Klein (1980) and other “vague predicate” analyses of comparative constructions, gradable adjectives denote partial functions from individuals to truth values. Applied to a context, they partition their domain into the positive extension, the negative extension and the extension gap. Thus, in a simple case, like (1a), the relation of Jimmy’s height to the standard of tallness in a given context is determined by ‘tall’ that specifies who counts as tall in the context.

\[
\text{tall} = \lambda c \lambda x 1 \text{ if } x \in \text{pos}_{\text{tall}}(c), 0 \text{ if } x \in \text{neg}_{\text{tall}}(c) \text{ and undefined otherwise,}
\]

where

\[
\text{pos}_{\text{tall}}(c) = \{u: u \text{ is tall in } c\} \text{ and } \text{neg}_{\text{tall}}(c) = \{u: u \text{ is not tall in } c\}
\]

Gradable adjectives can be modified by various degree adverbs that denote a family of degree functions specifying how exactly partitioning is to be done. Thus, measure modifiers make vague predicates precise in that they turn them into properties holding of entities of the particular size, e.g. ‘six foot’ maps ‘tall’ to a set of entities that are equal in length to 6 foot (the sixth element of the standard sequence based on foot), see Klein (1980, p. 28). Other modifiers, such as ‘very’, ‘fairly’, ‘extremely’, do not eliminate the extension gap as numerical modifiers but shift the boundary of the positive extension in a lexically specified way. For example, ‘very’ turns ‘tall’ into a new vague predicate that is like the original one except for the contextual comparison class with respect to which it is evaluated. The comparison class is set to the positive extension of ‘tall’ in the given context, see (22).

\[
(21) \quad \text{[tall]} = \lambda c \lambda x \begin{cases} 1 \text{ if } x \in \text{pos}_{\text{tall}}(c), & 0 \text{ if } x \in \text{neg}_{\text{tall}}(c) \text{ and undefined otherwise,} \\ \end{cases}
\]

a. For any context \(c\): \(c[\lambda]\) is that context \(c'\) just like \(c\) except that the comparison class in \(c'\) is \(X\).

b. \[
\text{[very]} = \lambda c \lambda K_{c(\ell)} \lambda x K(c[X])(x), \text{ where } X = \{u: K(c)(u) = 1\}
\]

Klein (1980, p. 42)

The comparative and the equative introduce quantification over degree functions and like numerical modifiers remove reference to the norm in the given context. For example, the comparative maps the vague predicate ‘tall’ in (1b) to a new predicate that is
true of Tony iff there is at least one degree function that makes ‘tall’ true of Tony and false of Jimmy. The equative is a universal quantifier over degree functions. Though successful and simple in accounting for the meaning of positive sentences and sentences with vague degree adverbs, this approach as it stands does not explain the norm-related readings of the comparative or the equative. However, the theory is technically equipped enough to offer us a means for deriving such readings. One such way is mentioned by van Rooij (2008, fn. 9), where he proposes to introduce a new class of operators that quantify over a restricted set of degree functions. For example, (1b) can be analysed as in (23a), according to which both Tony and Jimmy are tall in $c$.

\[(23) \quad \begin{align*}
& a. \quad \Box f \Box F^* \left[ f(\[\text{tall}] \right) (c)(\text{Tony}) \land ((\neg f)(\[\text{tall}] \right)) (c)(\text{Jimmy})] \\
& b. \quad F^* = \{ f; f(\[\text{tall}] \right)(c) \subseteq \[\text{tall}] (c) \} \\
& c. \quad \neg f = \lambda f \lambda p \lambda c (\[\text{tall}] (c) - (f(\[\text{tall}] \right)) (c)
\end{align*}\]

However, this proposal does not address the distribution of the norm-related readings. In general, a vague predicate analysis as developed in Klein neither can explain why the polarity of an adjective may be decisive in this respect nor can it offer any explanation for the contrast between Russian and English with respect to norm-relatedness. Another problem is the ban on numerical modifiers under the norm-related interpretation. If differential measure phrases can be integrated into this kind of analysis, see Klein (1991), there is nothing in the theory that would prevent their occurrence in the norm-related cases. The same can be said about the ratio modifiers in the equative and the contrast in (17a).

### 3.2 Degrees

Degree theories assume that gradable adjectives make use of scales formed from abstract entities called degrees. Degrees are usually defined in the style of Cresswell (1976) as equivalence classes of individuals, see (24). The ontology is enriched to include the semantic type of degrees and the denotation domain of this type, (25a-b).

\[(24) \quad \begin{align*}
& a. \quad \text{Let } \succ \text{tall be the empirically given relation ‘taller than’ and } F(\succ \text{tall}) \text{ its field.} \\
& \quad x, y \in D \quad \text{iff } x \succ y \text{ and } y \succ z \text{ iff } x \succ z \text{ and } z \succ y \text{ with } \succ \text{tall } x \text{ and } z \text{ with } \succ \text{tall } y \\
& b. \quad \text{A ‘tallness’ degree:} \\
& \quad [u] \text{tall } \subseteq D \iff \{ x \in D \mid y \in D \quad \text{iff } x \succ y \text{ with } \succ \text{tall } x \} \\
& c. \quad \text{Ordering on ‘tallness’ degrees:} \\
& \quad \text{Let } D \text{tall be the set of tallness degrees.} \\
& \quad d, d' \in D \text{tall} \quad d \succ d' \text{ iff } x \in D \quad d \text{d} \text{e} \text{e} \text{ of the ordering on } X, \text{ a scale.}
\end{align*}\]

\[(25) \quad \begin{align*}
& a. \quad \text{Let } D \text{ be the semantic type of degrees.} \\
& b. \quad \text{Let } D \text{d} \text{ consist of disjoint sets of degrees of various sorts.} \\
& c. \quad \text{Call each pair } (X, \succ) \text{, s.t. } X \subseteq D \text{d} \text{ and } \succ \text{ is the ordering on } X, \text{ a scale.}
\end{align*}\]
One of the ways to conceive predicates like ‘tall’ and ‘short’ in a degree approach is as relations between individuals and degrees that use measure functions of the respective sort. A measure function maps an individual to its equivalence class based on some property, e.g. \( \text{HEIGHT} \) defined in (26c) maps an individual to its height.

\[
\begin{align*}
\text{a. } & \text{ tall} = \lambda d \square F(\succ \text{tall}) \lambda x \text{ HEIGHT} (x) = d \\
\text{b. } & \text{ short} = \lambda d \square F(\prec \text{short}) \lambda x \text{ HEIGHT} (x) = d^2 \\
\text{c. } & \text{ HEIGHT} = \lambda x. 1: d \square D_{\text{tall}} \land x \sqcap d
\end{align*}
\]

In this setup, in the LFs of (1a-b) it is assumed that the degree morphemes bind the degree argument of ‘tall’ and express the relevant type of comparison. The comparative turns the gradable predicate \( A \) into a relation that maps a degree \( d \) to a property that holds of \( x \) if \( x \)'s degree of \( A \)-ness exceeds \( d \), see (27a). The positive does not take a degree argument but receives the standard-of-comparison value from the context, (27b). The analysis of (1b) is sketched in (28a-b). The embedded clause is assumed to express a definite degree expression.

\[
\begin{align*}
\text{a. } & \text{ COMP} = \lambda A \lambda d \lambda x \text{ \( d \) is a relation that maps a degree to a property} \\
\text{b. } & \text{ POS} = \lambda A \lambda x \text{ \( d \) is a relation that maps a degree to a property}
\end{align*}
\]

If we pursue this approach to comparatives, the interpretation of subdeletion examples like (29a) is not so straightforward. The two degrees that are to be compared here form different scales and cannot be directly related to each other. This kind of comparatives could be analysed as involving an additional step, namely, that of mapping the resulting degrees to real numbers. Let \( \text{NUM} \) be a function that maps a unit of measurement and a degree to the real number that corresponds to the number of times the unit must be concatenated with itself to form the abstract object representing the degree. We can now define a number-relating comparative morpheme that is applied if the conventional one in (27) fails to compare the two degrees, see (29c-e).

\[
\begin{align*}
\text{a. } & \text{ The desk is higher than the door is wide.} \\
\text{b. } & \text{ HEIGHT}(\text{the desk}) > \text{ WIDTH}(\text{the door}) \quad \text{(undefined!)} \\
\text{c. } & \text{ COMP}^{\text{num}} = \lambda A \lambda n \lambda x \text{ NUM}(u)(1 \sqcap A(d')(x)) >_R n, \text{ where } >_R \text{ is } ‘>’ \text{ or } ‘<’ \text{ ordering on real numbers}. \\
\text{d. } & \text{ the desk } [\text{COMP}^{\text{num}} \text{ higher}] [\text{NUM} \lambda d \text{ the door d wide}] \\
\text{e. } & \text{ NUM}(u)(\text{HEIGHT}(\text{the desk})) > \text{ NUM}(u)(\text{WIDTH}(\text{the door}))
\end{align*}
\]

---

2 We presuppose that the equivalence classes base on the relations \( \succ \text{tall} \) and \( \succ \text{short} \) are identical and therefore the degrees of tallness are not distinguishable from the degrees of shortness, hence the use of the same measure function in the definition of ‘tall’ and ‘short’.

3 We make the assumption that ‘\(<’ is employed to compare two numbers if the adjective argument of the number-relating comparative operator is an \( A \).
NUM would then also be at work in the interpretation of measure phrases. Differential measure phrases like ‘by 5 cm’ in (30a) specify the distance between the numbers that NUM maps each of the compared degrees and the measure unit to, see (30b-c). The measure phrase ‘1.80 m’ in (31a) has a different function. It points to a degree of the appropriate type that is directly fed into the adjective meaning to yield a statement about Jimmy’s height. Let us assume that the mapping of a number and a unit to a degree is performed by the operator EQ as shown in (31b-c).

(30)  a. Tony is taller than Jimmy by 5 cm.
     b. \[ by 5 \text{ cm} = \lambda R \lambda A(d_{Det}) \lambda d \lambda x_c R(A)(d(x)) \land \text{DIFF}(d, d'(A(d')(x)), \text{cm}) = 5 \]
     c. \[ d, d' \subseteq D_d : \text{DIFF}(d, d', u) = |\text{NUM}(u)(d) - \text{NUM}(u)(d')| \]

(31)  a. Jimmy is 1.80 m tall.
     b. Jimmy \[[\text{EQ} \ 1.80 \text{ m} \text{ tall}]\]
     c. \[ \text{EQ} \ 1.80 \text{ meter} = \lambda w \text{NUM}(\text{meter})(d) = 1.80 \]

The equative sentence in (32) can be assumed to have the same structure as the measure phrase construction in (31a) except that the degree argument of ‘tall’ is not created by the EQ operator from a number and a unit but is referentially linked to the correlative phrase. In many languages, including Russian, the correlate in the main clause may surface as a pronoun, e.g. in (4).

(32)  Tony is as tall as Pat.

Interestingly, this analysis when applied to the English data we discussed in section 2 makes the obligatorily norm-related environments look distinct from the ones where this inference can be cancelled. Their distinct characteristic is that in they do not distinguish truth-conditionally between the sentences with A+ and A–. This observation was first made in Rett (2008) for ‘how’ questions and equatives. Indeed, under the assumption that antonymous degrees refer to the same equivalence classes, see footnote 2, the equative in (33) and the ‘how’ question in (34) end up having the same extension in the A+ and the A– case.

(33)  a. The desk is as wide/narrow as the doorway.
     b. WIDTH(the desk) = WIDTH(the doorway)

(34)  a. How wide/narrow is the desk?
     b. \{p: \[d \ p = \lambda w \text{WIDTH}(\text{the desk}) = d\}\}

Note that the measure phrase construction and the subdeletion comparatives, repeated in (35) and (36), reveal this property too. In the subdeletion case, we are forced to apply the number-relating comparative. This renders the pairs in (36a) and (36c) differing only in the polarity of the embedded predicate truth-conditionally equivalent.

(35)  a. The desk is 70 cm wide/*narrow.
     b. WIDTH(the desk) = \lambda d(\text{NUM}(\text{cm})(d) = 70)
Norm-Relatedness in Degree Constructions

(36)  
a. The doorway is higher than the desk is wide/narrow.
    b. NUM(u)(HEIGHT(the doorway)) > NUM(u)(WIDTH(the desk))
    c. The doorway is lower than the desk is wide/narrow.
    d. NUM(u)(HEIGHT(the doorway)) < NUM(u)(WIDTH(the desk))

One can follow the strategy developed in Rett (2008) and assume that the process of semantic competition between the marked A– and unmarked A+ forces us in these cases to parse the sentences with A– as involving a positive morpheme that she calls EVAL and defines as an optional degree modifier. For example, in (37) EVAL would restrict the degree set it attaches to include only degrees that exceed the contextual standard for narrowness. As a result, the answer to (37a) has to be norm-related.

(37)  
a. How narrow is the desk?
    b. how? [EVAL [λd the dest d narrow]]
    c. {p: f d p = λw WIDTH(the desk) = d & d > g(C)}

However, this approach does not attempt and, for that matter, cannot give us an answer to the question why measure phrases are incompatible with the norm-related interpretation. What is worse it makes an absurd prediction that the measure phrase construction is optionally norm-related and therefore (31a) can be false if Jimmy’s height, 1.80 m, does not exceed the contextual standard of tallness, cf. (38).

(38)  
HEIGHT(Jimmy) = 1 d(NUM(meter)(d) = 1.80) & d > g(C)

In general, degree based theories are inept to handle the norm-related comparison. According to the standard approach, pursued in Bierwisch (1989) and taken up in Kennedy (1997), norm-related comparatives or comparatives of deviation relate the degrees of deviation from the contextual norm(s). It is clear that such deviation degrees can be only obtained by applying the distance function to two numbers, which is exactly what we want to avoid in order to account for the ban on numerical expressions in the norm-related contexts.

4 Proposal

We want to make use of the obvious advantage of the degree analysis outlined in section 3.2, namely its ability to distinguish the obligatorily norm-related environments from the others. At the same time, we do not want to inherit its problems in dealing with measure modifiers in the norm-related contexts. This brings us to the lexical ambiguity hypothesis. Let us assume that gradable adjectives are ambiguous between the vague predicate and the scalar meaning. The vague predicate meaning is responsible for the norm-relatedness. The analysis of numerical expressions is based on degrees as proposed in 3.2 and so they are allowed to occur only in the scalar meaning contexts. It remains to spell out the factors that determine when which meaning is selected.
4.1 Degree Morphology: The Case of Russian

The empirical pattern that we observe in Russian, see section 2.1, suggests that the choice of the scalar meaning for a gradable adjective is triggered by the comparative morphology. We propose the following rule for Russian:

(39) The scalar meaning of a gradable predicate must be licensed by the degree morphology.

The consequence of (39) is that all comparative constructions in Russian, except for the synthetic comparative, employ the vague predicate meanings of gradable adjectives. We are faced with deriving the norm-related interpretations in the vague predicate approach. We propose that the correlate ‘ɭɚɤɚя’/‘that’ in the main clause of a Russian equative construction, e.g. in (4), does not refer to a degree but to a degree function, see (40b). Recall that the expressions denoting degree functions now exclude the numerical modifiers that neutralise norm-relatedness. Since the role of degree functions is to fix the comparison class parameter in a given context, (40a) can serve as a paraphrase for the meaning of (4) under this analysis.

(40) a. Katja is tall with respect to the same comparison class with respect to which Larissa is tall.
    b. \( t \circ f(\circ \text{tall} ) (\circ \text{Katja}) = t \circ f(\circ \text{tall} ) (\circ \text{Larissa}) \)

One prediction of the analysis in (40) is that (4) can be truthfully uttered in a situation in which Katja’s and Larissa’s heights are not equal. (4) is predicted to only convey that Katja and Larissa are both tall with respect to the same standard of tallness. The inappropriateness of B’s remark in (41) indicates that this is indeed the case.

(41) A: Ʉɚɬя ɞɨɜɨɥɶɧɨ ɜɵɫɨɤɚя. Ɉɧɚ ɟɳɟ ɜɵɲɟ Ʌɚɪɢɫɵ.
    B: *Ɉɧɚ ɧɟ ɜɵɲɟ, ɚ ɬɚɤɚя ɠɟ ɜɵɫɨɤɚя.
    ‘A: Katja is rather tall. She is even taller than Larissa.
    B: She is not taller but as tall as Larissa.’

While the equative construction involves a reference to a degree function, the analytic comparative expresses comparison of degree functions. To implement this idea we need to define an ordering on degree functions. Assume that vague degree adverbs form a natural scale of the kind shown in (42). The comparative in (8b) repeated below as (43a) does not compare the degrees of tallness as its synthetic counterpart in (8a) but the degree functions that specify the comparison class with respect to which the subject and the object are asserted to be tall (43b-c).
(42) somewhat < … < very < … < extremely

(43) 
   a. Катя более высокая, чем Сергей.
      Катя more tall than Сергей
   b. Катя [[COMP tall] [DEF λf Sergej f tall]]
   c. \( t(f(\emptyset \text{ tall}))(\text{Katja}) < t(f(\emptyset \text{ tall}))(\text{Katja}) \)

For other norm-related constructions like the superlative in (12) and the intensional comparison constructions in (10)–(11) we need to specify the interpretation of their degree adverbs. Roughly, the superlative ‘самый’/‘most’ that also uses the lexical scale in (42) requires that the degree function that makes the adjective true of the subject is ranked higher than the degree functions that make other individual in the given comparison class true of the adjective. The intensional adverbs ‘слишком’/‘too’ and ‘достаточно’/‘enough’ restricts the comparison class to include only those individuals that make the modalised statement of the embedded clause false and true respectively. In (10a), the extension of ‘достаточно высокая’/‘tall enough’ in the given context is the set of individuals who are tall and can reach the shelf.

To sum up, Russian does not exploit the scalar meaning of gradable adjectives unless they are morphologically marked for comparison. We proposed to pursue a Klein’s style approach to interpret the indirect comparison constructions and showed that their meaning can be derived by manipulating the comparison classes.

### 4.2 Semantic Competition: The Case of English

In contrast to Russian, resolving the ambiguity of an English adjective does not depend on the degree morphology but on its polarity. We believe that the markedness of A– with respect to their A+ counterparts and the process of semantic competition are at stake here. If assume that A– are marked\(^4\) the process of semantic competition can be described as follows:

(44) If two degree constructions \(X(A–)\) and \(X(A+)\) are truth-conditionally equivalent and the speaker utters the marked \(X(A–)\) then she had a reason to do so, namely to employ the meaning of \(A–\) that renders \(X(A–)\) and \(X(A+)\) non-synonymous.

This line of reasoning as well as the fact that NUM is defined on degrees and cannot be applied to vague predicates accounts for the subdeletion paradigm we considered above. Recall that the comparative fails to relate two degrees if they are the values of different measure functions. The number-relating comparative can remove the problem by mapping the resulting degrees to the real numbers. This is what happens in (45a) and (45c). If the embedded clause features a marked A– as in (45b) and (45d) the rea-

---

\(^4\) This assumption can most probably get independent empirical support from language acquisition or processing.
soning in (44) can be applied since these two examples come out equivalent with (45a) and (45c) respectively as we showed in (36). As a result, the vague predicate meaning is selected and only the indirect comparison analysis along the lines we outlined in the previous section is possible. The reduced acceptability of these examples, as noted in Bierwisch (1989), corresponds to the fact that the assignment of the norm-related reading is a kind of re-interpretation strategy.

(45)  
\begin{itemize}
  \item a. The doorway is higher than the desk is wide.
  \item ??b. The doorway is higher than the desk is narrow.
  \item c. The doorway is lower than the desk is wide.
  \item d. The doorway is lower than the desk is narrow.
\end{itemize}

Another welcome prediction of our proposal is the unacceptability of ratio modifiers with A– equatives and the A– measure phrase construction in (35). Assuming ‘twice’ has the semantics in (46), it cannot apply in (33) where the scalar meaning of A– is banned. For the same reason, EQ is undefined in the A– variant of (35). The subdeletion equatives in (47) require the accommodation to numbers step. Obviously, the insertion of NUM is blocked in the process of semantic competition if one of the adjectives is A–.

(46) \[
\begin{align*}
\text{twice} & = \lambda d \ d' \ (2 \ast \text{NUM}(u)(d) = d')
\end{align*}
\]

(47) The desk is twice as wide/*narrow as the doorway is high/*low.

To conclude, the assumption that A– are marked and enter the process of semantic competition with their positive pole counterparts correctly predicts the distribution of direct comparison readings and measure phrases in English.

5 Conclusion

We propose that gradable predicates are lexically ambiguous. Norm-relatedness is the result of preferring the vague predicate meaning of a gradable predicate to the scalar one. In English, the polarity of the adjective and the process of semantic competition govern the selection of the meaning. In Russian, only degree morphology can license the scalar meaning. This strategy has proved successful in explaining some puzzling and so far unresolved asymmetries in the distribution of antonyms and handling the cross-linguistic variation in the distribution of norm-relatedness. The two patterns that we observe in Russian and English do not have to be exhaustive. We would expect languages to vary in how often and under which conditions they employ the scalar meaning.
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Preface

The 13th installment of the annual meeting of the Gesellschaft für Semantik, Sinn und Bedeutung 13, took place September 30—October 2, 2008 at the University of Stuttgart. Our invited speakers were Gerhard Jäger, Lauri Karttunen, Alex Lascarides, and Claudia Maienborn. In addition, 42 submitted abstracts were selected for presentation. We are delighted to be able to include 38 of these in the proceedings.

On behalf of the organizers – Ljudmila Geist, Klaus von Heusinger, Hans Kamp, Udo Klein, Fabienne Martin, Edgar Onea, Arndt Riester, and Torgrim Solstad – we would like to thank the speakers, reviewers and student helpers for making SuB13 such an inspiring and enjoyable event. We are also much obliged to Nina Seemann for assisting us with the typesetting of this document.

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Stuttgart, May 20, 2009
Arndt Riester
Torgrim Solstad
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Counting Configurations

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Abstract

The sentence *With these three shirts and four pairs of pants, one can make twelve different outfits* does not entail that one can dress twelve persons. The article proposes an analysis of “configurational” entities like outfits as individual concepts. It investigates the interaction of noun phrases based on such nouns with temporal and modal operators and in collective and cumulative interpretations. It also discusses a generalization from tokens to types, as in *with the seven pieces of a tangram set, one can lay dozens of figures*, suggesting an analysis of outfits and tangram figures in terms of properties.

1 What are Configurations?

“Configurations” is a term that I will use for what the italicized terms in sentences like the following refer to:

(1) a. You have 3 shirts and 4 pairs of pants. *How many different outfits* can you make? [...] You get *twelve outfits*. Not counting if a dude makes an outfit without a shirt, or a crazy person without pants.¹

b. [Description of a tangram set.] With just seven simple pieces, you can make *dozens of amazing shapes*.²

c. [Description of fischertechnik crane construction kit:] 100 Bauteile ermöglichen den Bau *dreier unterschiedlicher, einfacher Kräne*. ‘With 100 construction parts one can build *three different, simple cranes*.³

---

¹ answers.yahoo.com/question/index?qid=20080723031442AAYcnr3. The text continues: *Now let’s say you throw in three different pairs of socks...then you’d have 3 shirts times 4 pairs of pants times 3 pairs of socks for 36. It can get crazy the more options you throw in there.*

² www.amazon.com/Think-Fun-4985-Tangram/dp/B000BXHP04

Arndt Riester & Torgrim Solstad (eds.)
Proceedings of Sinn und Bedeutung 13, University of Stuttgart, 2009
d. [Description of Scrabble Word Builder:] We typed in the letters C, D, P, N, Y, E, A, and U and the Word Builder provided dozens and dozens of words that could be created with those letters."

Our main concern here is in the fact that even though the sentences in (1) talk about twelve outfits, dozens of tangram shapes, three cranes, and dozens of words, they do not imply that at any one possible world or point in time, dozens of shapes, twelve outfits, three cranes exist, or dozens of words constructed with a set of eight scrabble pieces coexist. For example, we can combine three shirts and four pairs of pants only to three outfits at a time. Nevertheless, the sentences in (1) are true. The number words appear to count things that exist across the different possible worlds or times referred to be the modal and temporal operators of the sentences. This might not appear so remarkable for examples (1.b,c,d) if tangram figure, crane, or word refer to types (or kinds), which presumably have a more abstract way of existence anyway. However, (1.a) does not lend itself to a type reading; the shirts and pants that are mixed and matched may well be unique.

Our main goal is to develop a semantic representation for configurational entity expressions that captures their semantic behavior in numeral constructions. I will start with sentences like (1.a), and look at singular, cumulative and collective interpretations. Then I will generalize the solution to account for the type-related readings that are more likely for (1.a).

2 The Problem with Configurations

The natural readings of the examples in (1) cannot be rendered if nouns like outfit refer to regular individuals, type e. Consider the following simplified example:

(2) It is possible to make four outfits with these two shirts and two pants.

We assume an interpretation format with explicit quantification over indices that stand for worlds or times (including time intervals), and with entities that can be combined to form sum entities. I use i, i’ etc. as variables over indices (type s), and u, u’ etc. as variables over entities (type e). The count noun outfit applies to single outfits that consist of combining pieces of clothing in culturally acceptable ways, cf. (3).

(3) \[\text{[outfit]} = \lambda i \lambda u[u \text{ consists of parts arranged in } i \text{ so that they form an outfit in } i]\]

The number word four can be represented in various ways. Let us assume the standard Generalized Quantifier analysis (where P is a variable over properties, type set).

---

3 spielwaren.1index.de/Fischertechnik@Cranes@Fischertechnik@Basic.19673.WOB00000001.137
4 www.education-world.com/a_lesson/dailylp/dailylp/dailylp099.shtml
Counting Configurations

(4) \[ [\text{four outfits}] = \lambda \vec{x}. P[\#(\lambda \vec{u}[[\text{outfit}](i)(u) \land P(i)(u))] \geq 4] \]

The verb *make* means ‘arrange the parts of \( u \) in a particular way’. It is true at an index \( i \) iff the agent arranges the parts of \( u \) at an index \( i' \) that immediately precedes \( i \), for which I will write \( i' \sqsubseteq i \) (cf. von Stechow 2001 for verbs of creation).

(5) \[ [\text{make}] = \lambda \vec{x}. u \lambda \vec{u} \exists i' [i' \sqsubseteq i \land u' \text{ arranges the parts of } u \text{ in } i'] \]

The PP headed by *with* is analyzed as an internal adverbal modifier. Let us assume that *this* refers to a sum individual consisting of two shirts \( s_1, s_2 \) and two pairs of pants \( p_1, p_2 \), where \( \oplus \) denotes the sum operation, and \( \sqsubseteq \) the part relation.

(6) \[ [\text{make with this}] = \lambda \vec{x}. u \lambda \vec{u} \exists i' [i' \sqsubseteq i \land u \sqsubseteq s_1 \oplus s_2 \oplus p_1 \oplus p_2 \land u' \text{ arranges the parts of } u \text{ in } i'] \]

Combining the meaning of an indefinite object *an outfit*, a subject DP *John*, and tense information (with \( < \) as the temporal precedence relation), and applying the resulting proposition to an index of evaluation \( i_0 \), we get the following interpretation:

(7) \[ [\text{John made an outfit with this}] (i_0) = \exists i < i_0 \exists u \exists i' [i' \sqsubseteq i \land u \sqsubseteq s_1 \oplus s_2 \oplus p_1 \oplus p_2 \land \text{John arranges the parts of } u \text{ in } i' \land u \text{ consists of parts arranged in } i \text{ so that they form an outfit in } i] \]

This says that there is a time \( i \) before \( i_0 \) that immediately follows a time \( i' \) during which John arranges parts of the two shirts and two pairs of pants, and that they form an outfit at the culminating time, \( i \). According to the intended understanding of *outfit*, there are four possible sum individuals that would qualify as outfits when properly arranged, namely \( s_1 \oplus p_1, s_1 \oplus p_2, s_2 \oplus p_1, \) and \( s_2 \oplus p_2 \). But at each index \( i \), only two of these can be arranged to an outfit simultaneously, namely \( s_1 \oplus p_1 \) and \( s_2 \oplus p_2 \), and \( s_1 \oplus p_2 \) and \( s_2 \oplus p_1 \).

Let us now look at our example, (2). The non-governed infinitival form existentially quantifies over the subject position:

(8) \[ [\text{to make with this}] = \lambda \vec{i}. \exists u \exists u' [i' \sqsubseteq i \land u \sqsubseteq s_1 \oplus s_2 \oplus p_1 \oplus p_2 \land u' \text{ arranges the parts of } u \text{ in } i'] \]

For the modal *possible* we assume the standard analysis as existential quantifier over indices that are elements of a set of indices \( R(i) \), the indices that are accessible from \( i \). In our case, accessibility means that the parts of the shirts and pairs of pants are combined such that they qualify as outfits relative to the standards of \( i \).

---

5 This does not capture a possible intentional component that John wanted to create an outfit, which is irrelevant for our purposes.
(9) \[ \text{[it is possible]} = \lambda i' \lambda p \exists i \in R(i') [p(i)] \]

We are now in a position to test whether we can generate the correct interpretation of (1.a), the reading that does not require that at any particular index, four outfits exist.

First, the modal might have wide scope with respect to the DP, resulting in the following interpretation at an index \(i_0\).

\[
(10) \quad \text{[[it is possible] [[four outfits] [to make with this]]]}(i_0)
= \lambda i [\text{[it is possible]}(i) (\lambda i'[\text{[four outfits]}(i') [\text{[to make with this]}(i'(u))]))(i_0)
= \exists i \in R(i_0) [\#(\lambda u [\text{[outfit]}(i)(u) \land u \subseteq s_1 \oplus s_2 \oplus p_1 \oplus p_2 \land \text{[to make]}(i)(u)]) \geq 4]
\]

This states that from \(i_0\) there is an index \(i'\) accessible from \(i_0\) such that the cardinality of outfits made with the two shirts and two pairs of pants at \(i'\) is at least four. Clearly, this is not the intended reading: it requires that four outfits are made at the same index.

Second, the DP might have wide scope with respect to the modal. This results in the following interpretation:

\[
(11) \quad \text{[[four outfits] \lambda t [it is possible [to make t with this]]]}(i_0)
= \lambda i [\text{[four outfits]}(i)(\lambda u [\text{[it is possible]}(i)(\lambda i'[\text{[to make with this]}(i'(u))]))(i_0)
= \#(\lambda u [\text{[outfit]}(i_0)(u) \land \exists i \in R(i_0) [\text{[to make]}(i)(u) \land u \subseteq s_1 \oplus s_2 \oplus p_1 \oplus p_2]) \leq 4
\]

This result is even worse because it states that there are four outfits made with the two shirts and two pairs of pants at the index of interpretation \(i_0\) itself.

### 3 An Individual Concept Analysis

What went wrong? The fault, I would like to argue, is with the analysis of outfits as simple entities, type \(e\), as suggested by (3). There cannot be four outfit entities at the same time. The solution I would like to propose is that outfits and their ilk are rather individual concepts, that is, possibly partial functions from indices to entities, type \(e\).

Individual concepts were used by Gupta (1980) to model the meaning of sentences like *National Airlines served two million passengers in 1975.* Gupta pointed out that this does not entail that National Airlines served two million persons, as one and the same person can perform the role of a passenger multiple times. Gupta’s solution – which analyzes passengers as individual concepts defined only for the time of a person’s flight – is problematic for passenger sentences, as we have the same interpretation for sentences like *National Airlines served two million persons in 1975* (cf. Krifka 1990). But individual concepts appear to be well-suited for configurations.

To illustrate the individual concept analysis, take the four outfits one can make with the two shirts \(s_1, s_2\) and the two pairs of pants \(p_1, p_2\). I make use of the notation introduced in Heim & Kratzer (1998) according to which an expression of the form \(\lambda v.\text{Restriction}[v]\). [Value[v]] denotes the (possibly partial) function from entities of the
type of v that is only defined for arguments for which Restriction[v] holds; if defined, the function gives as value whatever is specified in Value[v].

\[ (12) \quad o_1 = \lambda i. s_1 \text{ and } p_1 \text{ are arranged as an outfit in } i. [s_1 \oplus p_1] \\
    o_2 = \lambda i. s_1 \text{ and } p_2 \text{ are arranged as an outfit in } i. [s_1 \oplus p_2] \\
    o_3 = \lambda i. s_2 \text{ and } p_1 \text{ are arranged as an outfit in } i. [s_2 \oplus p_1] \\
    o_4 = \lambda i. s_2 \text{ and } p_2 \text{ are arranged as an outfit in } i. [s_2 \oplus p_2] \]

For example, \( o_1 \) is an individual concept that is only defined for indices \( i \) if \( s_1 \) and \( p_1 \) are arranged as an outfit in \( i \); if defined, \( o_1 \) maps to the sum individual consisting of \( s_1 \) and \( p_1 \). As one piece of clothing cannot be part of two outfits at a given index, the outfit concepts \( o_1, o_2 \) and \( o_3 \) have non-overlapping domains; only the outfits \( o_1 \) and \( o_4 \) and the outfits \( o_2 \) and \( o_3 \) can co-exist, as they consist of non-overlapping parts.

The individual concept analysis should not be restricted to configurations, of course. Take a regular entity, like Wolfgang Amadeus Mozart; he can be represented as individual concept that maps all indices \( i \) at which Mozart exists to Mozart – in our world, these are all indices from January 27, 1756 to December 5, 1791. In contrast to configurations, this is a convex set of indices: If \( i \) and \( i' \) are indices of the same possible world that are in this set, and if \( i'' \) is an index of the same possible world that is temporally in between \( i \) and \( i' \), then \( i'' \) is in this set as well. – Second, take role concepts like the tallest man, or the Pope. In contrast to configurations, they may refer to different entities for different indices. – Third, take individual concepts like the denotation of the gifted mathematician that John claims to be (cf. Grosu & Krifka 2008). Like configurations, they denote individual concepts referring to the same entity, but are restricted to those indices that are compatible with John’s claims.

Gupta analyzed common nouns as properties of individual concepts, type s(set), and we will follow him here. The common noun outfit applies to individual concepts like \( o_1 \) in (12), and not to simple entities. I first give the extension of this common noun meaning at an index \( i_0 \) in the set notation; it is of type (set).

\[ (13) \quad [\text{outfit}] (i_0) = \{ \lambda i. \text{ the parts of } u \text{ are arranged in } i \text{ to qualify as outfit in } i_0. [u] \mid u \in D_e \} \]

This is the set of all functions from indices \( i \) to entities \( u \) in the universe \( D_e \), whose parts are arranged in such a way in \( i \) that they qualify as an outfit at the index of interpretation, \( i_0 \). This accounts for the fact that there might be indices at which we do not consider the arrangement of a striped shirt and a checkered pairs of pants a suitable outfit. We get the intension of this set by lambda-abstraction over \( i_0 \), as usual.

Notice that it might be that at a given index \( i_0 \), all the individual concepts in \([\text{outfit}] (i_0)\) are such that they are not defined for \( i_0 \), because their parts are not arranged in \( i_0 \) in the proper way. Nevertheless, \([\text{outfit}] (i_0)\) is not empty in this case. To give a concrete example, assume a set of seven indices \( i_0, \ldots, i_6 \), and assume that the four outfits mentioned in (12) are as follows:
\[ (14) \quad o_1 = [i_1 \rightarrow s_1 \otimes p_1, i_2 \rightarrow s_1 \otimes p_1] \quad o_2 = [i_4 \rightarrow s_2 \otimes p_2, i_5 \rightarrow s_1 \otimes p_1] \]
\[ o_3 = [i_5 \rightarrow s_2 \otimes p_1, i_6 \rightarrow s_2 \otimes p_1] \quad o_4 = [i_2 \rightarrow s_2 \otimes p_2, i_3 \rightarrow s_2 \otimes p_2] \]

Notice that \( o_1 \) and \( o_4 \) both exist for \( i_2 \), and \( o_2 \) and \( o_3 \) both exist for \( i_5 \), but that \( o_1 \) and \( o_4 \) as well as \( o_2 \) and \( o_3 \) do not coexist. At \( i_0 \) no outfit exists at all. But the noun \textit{outfit} denotes for all indices, including \( i_0 \), the set of all these individual concepts, if what qualifies as outfit is the same for all indices:

\[ (15) \quad \textsf{[outfit]} = \lambda i \in \{i_0, \ldots, i_6\} \ [\{o_1, o_2, o_3, o_4\}] \]

It simplifies the grammatical description if we assume that common nouns and verbal predicates in general are properties of individual concepts, following the methodological principle of Montague grammar of generalizing types to the most complex case. With extensional predicates like \textit{be on the table}, they can be reduced to entities (in the following, I use \( x, x' \) etc. as variables over individual concepts).

\[ (16) \quad \textsf{[be in the laundry machine]} = \lambda i \lambda x [x(i) \text{ is in the laundry machine at } i] \]

That is, the property is ascribed to \( x(i) \), the value of the individual concept \( x \) at the index \( i \). Non-extensional predicates like \textit{rise or change} are not reducible in this way (cf. Montague 1973). Verbs of creation like \textit{make} state that an agent causes an individual concept to be realized at an index. For example, if John makes outfit \( o_1 \) at an index \( i \) then John caused during an interval preceding \( i \) that at \( i \), \( o_1 \) is defined. This presupposes that during the making of \( i \), \( o_1 \) was not defined (one cannot be making something that exists already) and entails that the agent acted upon the parts that \( o_1 \) refers to, \( s_1 \otimes h_1 \), in the time before \( i \). The essential parts of this is captured in the following interpretation.

\[ (17) \quad \textsf{[to make]} \]
\[ = \lambda i \lambda x \exists x' \exists i'. \ i' \angle i \wedge \neg i' \in \text{DOM}(x) \ [i \in \text{DOM}(x) \wedge x' \text{ acts on } x(i) \text{ in } i'] \]
\[ = \lambda i \lambda x [\text{someone realizes } x \text{ at } i] \text{ (in short)} \]

The DP \textit{four outfits} will get the following interpretation, with \( P \) is a variable for properties of individual concepts, type \( s(\text{set}) \).

\[ (18) \quad \textsf{[[DP four outfits]]} = \lambda i \lambda P \ [\#(\lambda x [\textsf{[outfit]}(i)(x) \wedge P(i)(x)]) \geq 4] \]

We now can give an appropriate interpretation to our example. It states that there are four outfit concepts such that there are accessible indices at which these outfits are made. Notice that the predication is understood as distributive: For each of these individual concepts, there is an accessible index at which it can be made.
(19) 
\[
\begin{align*}
&\llbracket [\text{four outfits}] \lambda t [\text{it is possible [to make t with this]]}] \rrbracket (i_0) \\
= &\llbracket [\text{four outfits}] (i) (\lambda x [\text{it is possible}] (i) (\lambda i' [\text{to make with this}] (i') (x))) \rrbracket (i_0) \\
= &\llbracket [\text{four outfits}] (i_0) (\lambda x [\text{it is possible}] (i_0) (\lambda i' [\text{to make with this}] (i') (x))) \\
= &\# (\lambda x [\text{outfit}] (i_0) (x) \land [\text{it is possible}] (i_0) (\lambda i' [\text{to make with this}] (i') (x))) \\
= &\# (\lambda x [\text{outfit}] (i_0) (x) \land \exists i' \in R(i_0) [\text{to make}] (i') (x) \land x \in \{ o_1, o_2, o_3, o_4 \}) \geq 4 \\
= &\# (\lambda x [\text{outfit}] (i_0) (x) \land \exists i' \in R(i_0) [\text{someone realizes}] (i') (x) \land x \in \{ o_1, o_2, o_3, o_4 \}) \geq 4
\end{align*}
\]

This is true iff for each of the four individual concepts there is an index $i'$ accessible from $i_0$ such that $x$ is realized by someone at $i'$. Notice that this does not entail that there is an index at which all four individual concepts are realized. In particular, (19) is compatible with a situation in which only two outfits can be realized at a time.

4 Sum Formation for Individual Concepts

4.1 Collective Interpretations

Our proposed treatment of sentences with reference to configurations allows only for a distributive interpretation, as distributivity is built in into the very nature of DPs like *four outfits*. However, we also find collective readings:

(20) Two outfits are rather similar to each other.

Equivalent readings of sentences with noun phrases that refer to regular individuals have been analyzed with the help of the notion of sum individuals (cf. e.g. Link 1983), and we can employ this idea in the present case as well.

One natural way in which the notion of sum formation can be extended to individual concepts is to lift the join operation $\oplus$ for entities to a join operation for individual concepts, as follows:

(21) $x \oplus y = \lambda i [x(i) \oplus y(i)]$

The join of two individual concepts, $x \oplus y$, is an individual concept that maps every index $i$ to the join of the individuals $x(i)$ and $y(i)$. But notice that this join is only defined in case $x(i)$ and $y(i)$ are defined. This may be useful for certain kinds of complex individual concepts, but not for the one we are after. In our example, the four outfits $o_1, \ldots, o_4$ do not all exist at the same index, hence $o_1 \oplus o_2 \oplus o_3 \oplus o_4$ will not be defined for any index. Hence we need a different join operation of individual concepts. One option is to use set formation; the join of the four outfits then is $\{ o_1, o_2, o_3, o_4 \}$. This is not an individual concept in its own right: It is not a function from indices to entities, but a set of such functions. Let us consider the construction of DPs with number words, like *two outfits*, in this framework.
\[ [\text{two}] = \lambda i \lambda P \lambda X [\#(X) = 2 \land X \subseteq P(i)] \]

\[ [[\text{NP two outfits}]] = \lambda i [ [\text{two}] (i)(\text{outfit}(i))] = \lambda i \lambda X [\#(X) = 2 \land X \subseteq [\text{outfit}](i)] \]

This is a property of sets of individual concepts, type s((set)\set). From it we can derive an indefinite DP which is interpreted as an existential quantifier that combines with a verbal predicate \( P \), a property of sets of individual concepts.

\[ [[\text{DP two outfits}]] = \lambda i \lambda P \exists X [[\text{NP two outfits}](i)(X) \land P(i)(X)] \]

The predicate \( \text{are similar} \) is a property of sets of individual concepts; it is true of such a set iff its elements are pairwise similar to each other.

\[ [[\text{DP two outfits}]] \text{ [are similar]} (i_0) = [[\text{DP two outfits}]](i_0)(\text{are similar}(i_0)) \]

\[ = \lambda P \exists X [[\text{NP two outfits}](i)(X) \land P(i)(X)](\lambda X \forall x, y \in X \text{x is similar y at } i_0)] \]

\[ = \exists X [\#(X) = 2 \land X \subseteq [\text{outfit}](i) \land \forall x, y \in X \text{x is similar y at } i_0] \]

Where similarity of two individual concepts \( x \) and \( y \) at \( i_0 \) means that according to the similarity standards of \( i_0 \), the realizations of \( x \) and the realizations of \( y \) are deemed similar. Notice again that this does not entail that \( x \) and \( y \) have realizations at \( i_0 \); \( \text{be similar} \) must be understood as an intensional predicate. We find this type of comparison with other cases of individual concepts, as in \( \text{two popes were similar to each other} \), which may be true even if the two popes were not contemporaries.

The interpretation of expressions like \( \text{two outfits} \) proposed here is also possible for the non-collective examples we started out with, provided that we assume that verbal predicates, when applied to sets of individual concepts, distribute over their elements. This can be implemented by a type lifting of verbal predicates to accommodate sets of individual concepts as arguments. The type lifting is indicated with *, a symbol that is sometimes used for the cumulative closure of a predicate, as we have cumulativity here as well, insofar as \( *P(i)(X) \land *P(i)(Y) \) entails \( *P(i)(X \cap Y) \).

\[ *P = \lambda i \lambda X \forall x \in X [P(i)(x)] \]

\[ *[\lambda t \text{[it is possible [to make t]]}] = \lambda i \lambda X \forall x \in X \exists i' \in R(i)[\text{s.o. realizes x at } i'] \]

The derivation of the reading of our original sentence is straightforward:

\[ [[[\text{DP four outfits}] \lambda t \text{[it is possible [to make t]]}]](i_0) = [[\text{DP four outfits}]](i_0)(*[\lambda t \text{[it is possible [to make t]]}]](i_0)) \]

\[ = \lambda P \exists X [\#(X) = 4 \land X \subseteq [\text{outfit}](i_0) \land P(i)(X)] (\lambda X \forall x \in X \exists i' \in R(i)[\text{someone realizes x at } i']) \]

\[ = \exists X [\#(X) = 4 \land X \subseteq [\text{outfit}](i_0) \land \forall x \in X \exists i' \in R(i)[\text{someone realizes x at } i']] \]
Notice that we do not assume a distributive operator here; distributivity is rather a consequence of type lifting expressed by the * operator.

4.2 Configurations and Temporal Operators

Examples like (28) involve a temporal operator, the perfect. Just as with modal operators, the sentence does not entail that the three outfits existed at the same time.

(28) John has made three outfits with these shirts and pants.

The proper representation of perfect tense is beyond the scope of this paper. What is important is that perfect clauses like John has arrived entail that there was a time prior to the time of utterance at which John arrives. Then we can give the interpretation (29), where the part in parentheses will be neglected, for the perfect. This enables derivations like in (30), which allows for each element x of the four outfit concepts X that they were made at different times i'.

(29) \[\begin{array}{c}
\text{\text{PERFECT}} = \lambda_{i,i'}p \exists i < i'[p(i') (\wedge \text{afterstate of } p(i') \text{ still holds at } i)]
\end{array}\]

(30) \[\begin{array}{c}
\begin{align*}
\text{[[DP three outfits] [have been made]](i_0)} & = \text{[[DP three outfits]](i_0)(*[\text{PERFECT [be made]](i_0)}) \\
& = \lambda P \exists X \#(X) = 3 \land X \subseteq \text{\textit{outfit}}(i_0) \land P(i_0)(X) \\
& \quad (\lambda x \forall x \in X \exists i' < i_0 [\text{someone realizes } x \text{ at } i']) \\
& = \exists X \#(X) = 3 \land X \subseteq \text{\textit{outfit}}(i_0) \land \forall x \in X \exists i' < i_0 [\text{someone realizes } x \text{ at } i']
\end{align*}
\end{array}\]

Notice that a simple past tense as in John made three outfits tends to have the reading for which the three outfits coexist. This is because past tense typically refers to a particular time given by the context. When we say that the three outfit concepts x of the set X were made at that particular time, then they must coexist at that time (or at the end of that time).

4.3 Cumulative Interpretations

Sets of individual concepts can also accommodate cumulative interpretations. Imagine that a kindergarten owns a construction set with which all kinds of vehicles can be constructed, but only one at a time (there are only four wheels).

(31) Dozens of children have built hundreds of vehicles with this construction set.
Such interpretations have been explained as a consequence of the cumulativity of verbal predicates (cf. Krifka 1989, Sternefeld 1998). That is, transitive predicates like build are interpreted such that if u builds v and u' builds v', then u@u' builds v@v'. This interpretation is triggered by Sternefeld’s operator **, here adapted as in (32). Let Q be a variable for relations between sets of individual concepts, type s(se)(se)t.

\[
**Q = \lambda i_0, X, Y [\forall x \in X \exists y \in Y [R(i_0)(x)(y)] \land \forall y \in Y \exists x \in X [Q(i_0)(x)(y)]]
\]

This operator enables derivations as in (33), where “>> 24” and “>> 200” state that a number is in the range of dozens and hundreds, respectively.

\[
[[\text{dozens of children}] [\text{have built}] [\text{hundreds of vehicles}]](i_0) = \lambda \exists X \#(X) \gg 24 \land X \subseteq [\text{child}](i_0) \land P(i_0)(X) \\
(\lambda R \exists X \exists Y [\#(Y) \gg 200 \land Y \subseteq [\text{vehicle}](i_0) \land R(i_0)(Y)(X)] \\
(\ast \ast [\text{PERFECT}](i_0)([\text{build}](Y)(X))) \\
= \exists X \exists Y [\#(X) \gg 24 \land X \subseteq [\text{child}](i_0) \land \#(Y) \gg 200 \land Y \subseteq [\text{vehicle}](i_0) \\
\land \forall x \in X \exists y \in Y \exists i' < i_0 [x \text{ realizes } y \text{ at } i'] \land \\
\forall y \in Y \exists x \in X [\exists i' < i_0 [x \text{ realizes } y \text{ at } i']]
\]

Here, X is a set of individual concepts that have the property of being children with respect to i_0. This set X contains dozens of elements. Similarly, Y is a set of individual concepts that are vehicle concepts with respect to i_0; the way things are set up, no two vehicle concepts exist at the same temporal index. Y contains hundreds of elements. For every element x of X there is an element y of Y and a time before t_0 such that x builds y at that time, and for every element y of Y there is an element x of X such that y was built by x at that time. Notice that this does not require that at any one time there exists more than one vehicle. It does require, though, that the builders of the vehicle are children at the time of the building, as the condition “x realizes y at i’” entails that the realization x(i') did the building at i', and if x is only defined for persons during their childhood years, then x must be a child during the time of the building of y. Notice, also, that this interpretation allows that children cooperate in the building of one vehicle, as the individual concept x may well refer to two or more children; cf. (21).

5 The Property Analysis, and Identity Criteria for Concepts

Condoravdi, Crouch & van den Berg (2001) have analyzed examples like (34) in a way that looks similar to what we have proposed for configurations.

\[
\text{(34) The mayor prevented three strikes.}
\]

Prevent is analyzed as an intensional predicate, like seek, which Condoravdi e.a. interpret, following Zimmermann (1993), as having a property argument:
\[ (35) \quad \text{The mayor prevented a strike}([i_0]) \\
= \exists i < i_0 \ [\text{prevent}](i) ([\text{strike}](\text{the mayor}))[i] \\
= \exists i < i_0 \ [\text{prevent}](i)(\lambda i', \lambda u [u \text{ is a strike in } i']) (m) \]

This captures the reading in which no reference to a specific strike is intended. But there is also a specific reading: There was a threat for a strike, and the mayor prevented that strike from happening. The normal solution for specific reading, giving the noun phrase wide scope (cf. (36)), does not work. It entails the existence of a strike \( u \) – but this is exactly what the next conjunct says was prevented.

\[ (36) \quad \exists i < i_0 \ \exists u [[\text{strike}](i)(u) \land [\text{prevent}](i)(\lambda i' \lambda v[u=v])(m)] \]

Condoravdi et. al. propose a solution for the specific interpretation using “subconcepts” (that is, subproperties). No strict definition is given, but we certainly should assume that a superconcept applies to all indices and individuals a subconcept applies to. The specific reading can be given as follows, where \( \subseteq_s \) is the subset relation.

\[ (37) \quad \exists P \subseteq_s \text{strike} \exists i < i_0 \ [\text{prevent}](i)(X)(m) \]

For the interpretation of three strikes, Condoravdi et al. (2001) discuss various options, settling on a generalized quantifier analysis:

\[ (38) \quad [\text{the mayor prevented three strikes}](i_0) \\
= \#(\lambda P[P \subseteq_s \text{strike}] \land \exists i < i_0 [\text{prevent}](i)(P)(m)) = 3 \]

But for this to work, the notion of subconcept must be properly restricted. One entity may fall under different subconcepts of strike, e.g. it might be a strike of the railroad workers and at the same time (as railroad workers are public workers) a strike of the public workers. Obviously, the subconcepts that we count should not be such that one is included in the other. Hence Condoravdi e.a. propose to restrict counting to minimal subconcepts, that is, to “maximally specific instantiated concepts”.

Using individual concepts instead of properties, we get minimality for free, as individual concepts can apply to maximally one individual. Hence it seems natural to apply the individual concepts analysis to examples of the type of Condoravdi e.a. (2001). The natural reading of (34) is that what the mayor prevented was that three specific strike threats led to a full-blown strike. In each world at which these strikes would have been realized, there would have been exactly one realization.

\[ (39) \quad [\text{The mayor prevented three strikes}](i_0) \\
= \exists X [\#(X) = 3 \land X \subseteq_s \text{strike}](i_0) \land \forall x \in X \exists i < i_0 [\text{m prevented } x \text{ at } i'] \]
This says that \( X \) consists of three individual concepts that are strikes, and that the mayor prevented them (possibly at three different times). To prevent an individual concept at an index \( i' \) means to act in such a way that the individual concept is not realized in the possible future continuations of the index \( i' \). That is, without the intervention, the individual concept \( x \) would have been realized at a normal continuation of \( i' \).

But there is still an issue of minimality to be considered: While individual concepts necessarily refer to one entity, they may be defined for a greater of smaller set of indices. For example, if \([i_1 \rightarrow e_1, i_2 \rightarrow e_2] \) is a strike (which is realized in \( i_1 \) by the event \( e_1 \), and in \( i_2 \) by the event \( e_2 \)), and if \([i_3 \rightarrow e_3, i_4 \rightarrow e_4] \) is a strike, what prevents us from saying that \([i_1 \rightarrow e_1, i_2 \rightarrow e_2, i_3 \rightarrow e_3, i_4 \rightarrow e_4] \) is a strike? Alternatively, what prevents us from saying that \([i_1 \rightarrow e_1] \) is a strike? Put differently, what would make us say that \([i_1 \rightarrow e_1] \) is the same strike as \([i_2 \rightarrow e_2] \), but that \([i_1 \rightarrow e_1, i_2 \rightarrow e_2] \) and \([i_3 \rightarrow e_3, i_4 \rightarrow e_4] \) are different strikes?

Like identity criteria in general, this depends on lexical semantics and cannot be determined by abstract principles. In the case at hand, there are complex issues involved, e.g. when an announced strike is declared illegal, and the workers announce another strike with similar goals and methods to circumvene the court ruling. Formal semantics can only provide the general format of the objects of lexical semantics.

With sentences referring to configurations, the adjective \textit{different} occurs quite naturally, cf. the examples in (1). This points to the greater relevance of identity criteria in such sentences. There are two competing strategies: First, we might count as one outfit, tangram figure or crane the maximally temporally convex individual concept that is a particular outfit, tangram figure, or crane. There is no contradiction in (40):

\[(40)\quad \text{John has made many figures with this tangram set, but he nearly always makes the same one – the ice-skater.}\]

\textit{Different} excludes such readings, hence indicates that a criterion of identity is used beyond temporal convexity. A similar effect was noticed by Barker (1999), who observed that the reading of \textit{National Airlines served two million persons} that is similar to (11) vanishes if the object is replaced by \textit{two million different persons}.

\section{Tokens and Types}

The preceding section argued that there are advantages of the individual concept analysis of strikes (and outfits) over the property analysis. However, the property analysis has its advantages when we consider the availability of type readings, in addition to the token readings of \textit{outfit} and \textit{strike} considered so far.

The type reading is quite natural for examples (1.b,c,d). We can distinguish between the type of tangram sets, or the type of a particular tangram shape like the ice skater, and the tokens that realize this type. The crucial difference is that tokens exist only once at a particular world and time, whereas types can be realized multiple times. But notice that, even under the type interpretation, it is still true to say: \textit{With a tangram set, one make dozens of figures, but only one at a time.}
There are different ways to model the type/token distinction. Types can be treated as kinds and tokens as exemplars that are related to kinds via a realization relation (cf. Carlson 1978). Or they may refer to the sum individuals of all tokens (cf. Chierchia 1998 for definite generics). But there is one way that hasn’t been explored so far, according to which types and tokens are properties, where types may apply to multiple entities at an index, whereas tokens may apply to maximally one entity. In this light, it is worthwhile to reconsider the property analysis of Condoravdi e.a. (2001). The type of a particular tangram figure, say the ice-skater, is realized by many tokens – all the tangram pieces that are in the configuration of the shape called the ice-skater.

(41)  \[ the \text{-skater} ](i_0)  \\
|  \lambda i \{ u \mid u \text{ is a tangram set in } i_0 \land \text{the parts of } u \text{ are put together in } i \text{ such that they form a shape that looks like an ice-skater, according to } i_0 \} |

If we concentrate on a single tangram set \( t \), then we can model tangram shape tokens in a similar way – as properties that map indices to singleton sets, or to the empty set.

(42)  \[ \text{the ice-skater made of the tangram set } t ](i_0)  \\
|  \lambda i \{ u \mid u = t \land \text{the parts of } u \text{ are put together in } i \text{ such that they form a shape that looks like an ice-skater, according to } i_0 \} |

This token belongs to the type of (41), as the following holds:

(43)  \forall i \forall i' \forall u [ \text{the ice-skater made of } t ](i)(i')(u) \rightarrow \text{[the ice-skater]}(i)(i')(u)

The predicate \text{tangram figure} applies to such properties, regardless whether they tokens or types; hence it is of type \text{s(set)}. We can define the set of tangram figure types and the set of tangram figure tokens as follows:

(44)  \[ \text{tangram figure (types)} ](i_0)  \\
|  \{ \lambda i \{ u \mid u \text{ is a tangram set in } i_0 \land \text{the parts of } u \text{ are put together in } i \text{ such that they form a shape that looks like } \alpha \} \mid \alpha \text{ is a tangram shape in } i_0 \} |

(44)  \[ \text{tangram figure (tokens)} ](i_0)  \\
|  \{ \lambda i \{ u \mid u = v \land \text{the parts of } u \text{ are put together in } i \text{ such that they form a shape that looks like } \alpha \} \mid v \text{ is a tangram set in } i_0 \text{ and } \alpha \text{ is a tangram shape in } i_0 \} |

A noun like \text{tangram figures} can be seen as ambiguous between the type reading and the token reading, or alternatively as vague – then it would refer to the union of the two readings indicated in (44). The use of \text{different} selects the type reading, or restricts the vague reading to it.

With this analysis of common nouns, we can treat sentences like \text{it is possible to make dozens of different tangram figures} with reference to tangram figure types...
rather than tokens. Following an analysis along the lines of (22) and (23) we have the
following meaning of the DP; here \( \mathbf{X} \) is a variable of type \( \text{set}t \), and \( \mathbf{P} \) is a variable of
type \( s(\text{set})t \).

\[
(45) \quad \llbracket [\llbracket \text{DP dozens of tangram figures (types)} \rrbracket] \rrbracket \\
= \lambda i \lambda \mathbf{X} \exists \mathbf{X}[\#(\mathbf{X}) > 24 \land \mathbf{X} \subseteq \mathbf{P}[\text{tangram figure (types)}] \llbracket i \rrbracket \land \mathbf{P}(i)(\mathbf{X})]
\]

The meaning of verbal predicates has to be adjusted to the property analysis. For ex-
ample, to \textit{make} a particular tangram figure (type) means to cause that an entity \( u \) that
was not in the extension of this tangram figure to become part of it. The definition of
\textit{to make} in (17) has to be replaced by the following, where \( \mathbf{x} \) now stands for properties.

\[
(46) \quad \llbracket \text{to make} \rrbracket \\
= \lambda i \lambda \mathbf{x} \exists \mathbf{x}' \exists u. i' \subseteq i \land \neg 
\mathbf{x}(i')(u) \land \mathbf{x}(i)(u) \land \mathbf{x}' \text{ acts on } u \text{ in } i'
\]

\[
= \lambda i \lambda \mathbf{x} \exists \mathbf{x} \text{someone realizes an } \mathbf{x} \text{ at } i \text{ (for short)}
\]

We now can analyze our example as follows:

\[
(47) \quad \llbracket [\llbracket \text{DP dozens of t. figures (types)} \rrbracket] \llbracket \text{it is possible [to make t]} \rrbracket \rrbracket \llbracket i_0 \rrbracket \\
= \llbracket [\llbracket \text{DP dozens of t. figures (types)} \rrbracket] \rrbracket \llbracket i_0 \rrbracket \llbracket \llbracket \text{it is possible [to make t]} \rrbracket \rrbracket \llbracket i_0 \rrbracket \\
= \lambda \mathbf{x} \exists \mathbf{x}[\#(\mathbf{x}) > 24 \land \mathbf{x} \subseteq \llbracket \text{tangram figure} \rrbracket \llbracket i_0 \rrbracket \land \mathbf{x}(i_0)(\mathbf{x})] \\
\quad \land \mathbf{x}(i_0)(\mathbf{x}) \\
= \exists \mathbf{x}[\#(\mathbf{x}) > 24 \land \mathbf{x} \subseteq \llbracket \text{tangram figure} \rrbracket \llbracket i_0 \rrbracket \land \\
\quad \forall \mathbf{x} \exists \mathbf{x}' \exists i' \in \mathbf{R}(i_0)[\text{someone realizes an } \mathbf{x} \text{ at } i']
\]

This says that there is a set \( \mathbf{X} \) containing dozens of property types that are all different
tangram figure types, and that for each property \( \mathbf{x} \) of this set there is an accessible index \( i' \)
at which \( \mathbf{x} \) is realized. This in turn means that some agent acts on a sum individual \( u \)
(the elements of a tangram set) such that it falls under the property \( \mathbf{X} \). This renders the
intended interpretation correctly. In particular, it does not imply that at any accessible
index dozens of tangram figure types are realized simultaneously.

## 7 Conclusion

In this paper I have outlined two different ways how to deal with what I called “configura-
tional” entities denoted by such terms as \textit{outfit} or \textit{tangram figure}. First, they can
be analyzed as partial individual concepts that are realized at some indices but not at
others. This predicts their behavior in modal and temporal clauses, and the analysis can
explain the behavior of such sentences in distributive, collective and cumulative inter-
pretations. The individual concept analysis is well-suited for the token readings of
these terms. For the type readings I suggested an alternative representation, as prop-
erties that could be generalized to token readings as well.
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References


On the Cross-Linguistic Interpretation of Embedded Tenses

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Abstract

We propose a semantic analysis of cross-linguistic variation in the distribution and interpretation of tenses embedded in propositional attitude complements and temporal adjunct clauses in English, Japanese and Russian. We compare our analysis to previous ones proposed by Ogihara (1994, 1996) and Arregui and Kusumoto (1998), which attribute the variation to syntactic differences between the languages, and argue that the semantic analysis is preferable on both empirical and conceptual grounds.

1 Introduction

This paper develops a semantic analysis of the distribution and interpretation of tenses embedded in propositional attitude complements (PACs) and temporal adjunct clauses (TACs) in English, Japanese and Russian. English examples illustrating the two types of clauses are given in (1):

(1) a. Ken said that Anna was sick. (PAC)
   b. Anna left before Ken arrived. (TAC)

The variation observed is that tenses in English and Russian TACs exhibit the same distribution (in contrast to Japanese tenses) whereas the interpretations of tenses are parallel in Russian and Japanese PACs (but different for English). Despite tense interpretation being a semantic phenomenon, previous analyses of (parts of) this cross-linguistic variation attribute the variation primarily to syntactic differences between the languages (cf. Ogihara 1994, 1996; Arregui and Kusumoto 1998). The current paper considers a broader set of languages and constructions than any single previous work, and demonstrates that a purely semantic analysis of the variation is possible once the fact that PACs and TACs impose distinct constraints on the interpretation of embedded tenses is taken...
into consideration. A comparison of the semantic analysis to the previous ones reveals empirical and conceptual advantages of the semantic analysis.

2 Tenses in embedded clauses

We assume that each of the three languages has a past and a non-past tense. The data in (2) show the (bold-faced) past tenses of the three languages: in matrix clauses, they result in interpretations where the eventuality denoted by the verb is temporally located prior to the speech time.¹

(2)  
   a. Ken arrived yesterday/#now/#tomorrow.  
   b. Japanese  
      Ken-ga kinoo/#ima/#asita ki-ta.  
      Ken-NOM yesterday/now/tomorrow arrive-PAST  
      ‘Ken arrived yesterday/#now/#tomorrow.’  
   c. Russian  
      Ken pri-exa-l včera/#sejčas#zavtra.  
      Ken PERF-arrive-PAST.MASC yesterday/now/tomorrow  
      ‘Ken arrived yesterday/#now/#tomorrow.’

Each language also has a tense form which (in matrix clauses) is compatible with non-past time reference, cf. (3). (These non-past tenses receive slightly different interpretations in the three languages depending on the Aktionsart of the proposition; we ignore these differences here since tenses are our primary concern.)

(3)  
   a. Anna is in her office #yesterday/now/tomorrow.  
   b. Japanese  
      Anna-wa #kinoo/ima/asita Tookyoo-ni i-ru.  
      Anna-TOP yesterday/now/tomorrow Tokyo-at be-NPST  
      ‘Anna is/will be in Tokyo now/tomorrow.’  
   c. Russian  
      Anna #včera/sejčas/zavtra poj-ot.  
      Anna yesterday/now/tomorrow sing-NPST  
      ‘Anna is singing now/Anna will sing tomorrow.’

English, Japanese and Russian differ in the distribution of tenses in TACs. We restrict our discussion here to ‘before’-clauses with past tense matrix clauses; comparable points can be made for ‘after’-clauses (cf. e.g. Ogihara 1994; Arregui and Kusumoto 1998). In (4), the TACs are enclosed in brackets:

¹We use the following glosses in this paper: COMPL = complementizer, FEM = feminine gender, INSTR = instrumental case, MASC = masculine gender, NOM = nominative case, NPST = non-past tense, PAST = past tense, PERF = perfective aspect, TOP = topic.
(4) a. Anna left [before Ken arrived/#arrives].

b. Japanese

Ken-NOM arrive-PAST/arrive-NPST before-at Anna-NOM leave-PAST
‘Anna left before Ken arrived.’

c. Russian

Anna u-exa-l-a [pered tem, kak Ken
Anna PERF-leave-PAST-FEM before that.INSTR as Ken
pri-exa-l/#pri-ed-et].
PERF-arrive-PAST.MASC/PERF-arrive-NPST
‘Anna left before Ken arrived.’

The matrix clauses in (4) are interpreted in the past of the speech time. In English (4-a) and Russian (4-c), past tenses are obligatory in the ‘before’-TACs whereas in Japanese the non-past tense is required (4-b). If the temporal connectives of all three languages locate the time at which the matrix clause is interpreted prior to the time at which the TAC is interpreted, the distribution of tenses in (4) points to differences in the interpretation of tenses in English/Russian versus Japanese TACs. In particular, the English and Russian TACs seem to be interpreted at the speech time since the interpretation of the embedded past tense is compatible with the meaning of the temporal connective: if the TACs were interpreted at the matrix event time, the embedded past tenses would locate the TACs prior to the matrix event time, thereby contradicting the meaning of the temporal connectives. The Japanese TAC, on the other hand, seems to be interpreted at the matrix event time since the interpretation of the non-past tense is compatible with the meaning of the temporal connective.

Traditionally, a tense that is interpreted at the speech time is called an ABSOLUTE tense whereas one that is interpreted at a time supplied by the linguistic context (and which may differ from the speech time) is called a RELATIVE tense (Comrie 1985). Thus, the data in (4) suggest that English and Russian tenses are absolute while those of Japanese are relative. We return to this below.

In PACs, both past and non-past tenses are permitted in the three languages but the languages differ in the interpretations the tenses realize. In (5), past tenses occur in the PACs and the matrix clauses. The English PAC in (5-a) is ambiguous between an interpretation where the time of Anna’s being sick precedes the time of Ken’s saying (the ‘back-shifted’ interpretation) and an interpretation where the time of Anna’s being sick overlaps with the time of Ken’s saying (the ‘overlapping’ interpretation). The Japanese PAC in (5-b) is ambiguous between an interpretation where the time of Anna’s being sick precedes the time of Ken’s saying (the ‘back-shifted’ interpretation) and an interpretation where the time of Anna’s being sick is at the time of Ken’s saying (the ‘overlapping’ interpretation). The English

---

2The term ‘matrix event time’ refers to the situation time of the eventuality denoted by the matrix clause.

3If English and Russian TACs are interpreted at the speech time, the non-past tenses should also be acceptable in ‘before’-TACs (contrary to fact), resulting in an interpretation of e.g. (4-a) according to which Anna’s past leaving is followed by Ken’s arrival at or after the speech time. We argue in Kubota et al. (2009) that the unavailability of such interpretations is due to a pragmatic constraint on temporal interpretation.
and Russian examples in (5-b) and (5-c), respectively, only receive the back-shifted interpretation.4

(5) a. Ken said [that Anna was sick].
   b. Japanese
      Ken-wa [Anna-ga byooki dat-ta to] it-ta.
      Ken-TOP Anna-NOM sick be-PAST COMPL say-PAST
      ‘Ken said that Anna had been sick.’
   c. Russian
      Ken skaza-l [čto Anna bole-l-a].
      Ken say-PAST.MASC that Anna be.sick-PAST-FEM
      ‘Ken said that Anna had been sick.’

In (6), we find non-past tenses in the PACs. The Japanese and Russian PACs in (6-b) and (6-c), respectively, receive an overlapping interpretation while the English PAC in (6-a) has the ‘double-access’ reading (Abusch 1997a).

(6) a. Ken said that Anna is sick.
   b. Japanese
      Ken-wa [Anna-ga byooki da to] it-ta.
      Ken-TOP Anna-NOM sick be.NPST COMPL say-PAST
      ‘Ken said that Anna was sick (at the time of saying).’
   c. Russian
      Ken skaza-l [čto Anna bole-et].
      Ken say-PAST.MASC that Anna be.sick-NPST
      ‘Ken said that Anna was sick (at the time of saying).’

The English PAC in (6-a) differs from the Japanese and Russian PACs in that for (6-a) to be true it is not sufficient for Ken to have said at a time in the past that Anna was sick at that past time (the overlapping interpretation); the interpretation of the PAC in (6-a) seems to additionally involve the speech time (hence the name ‘double-access’ reading). This additional meaning of (6-a) is not just the assertion that Ken said at some time in the past that Anna would be sick at the speech time. For speakers who accept (6-a), the sentence means something along the lines that, according to Ken’s belief, Anna was sick at the time he make his remark, and that his belief was such that the speaker could attribute to him an additional, consequential belief that, if everything took the normal course of events, then Anna would still be sick at the speech time.

Assuming that the matrix clause verbs in the three languages make the same contributions to the temporal interpretation of the embedded clauses, the variation observed in (5) and (6) again suggests differences in the interpretations of embedded tenses in the three languages. In particular, the Japanese and Russian PACs seem to be interpreted with respect to the matrix event time, which, on the traditional classification, means that

4 Altshuler (2008) points out that Russian past-under-past PACs can receive an overlapping interpretation in certain discourse contexts. We leave open the question of how such examples could be accounted for in the analysis we propose here.
they are relative tenses. But now Russian presents a problem for the traditional classification: TACs motivate that Russian tenses are absolute while PACs motivate that they are relative. English likewise poses a problem since the non-past tense in PACs needs to be interpreted at the speech time and the matrix event time—simply saying that it is relative (or absolute, or both) is not satisfying. Thus, the traditional classification of tenses into relative and absolute tenses is inadequate. We return to this in §3.3.

# 3 A semantic analysis of the variation

This section develops a semantic analysis of the variation in temporal interpretation observed above. The notion of local evaluation time, which is the time at which a tense is interpreted, plays a key role in our analysis. For matrix clause tenses, the local evaluation time is always the speech time. For embedded tenses, our proposal, in short, is that there is variation both among languages and among constructions as to which time is identified as the local evaluation time. For PACs, we argue that, due to the fact that PACs denote mental attitudes ascribed to some attitude holder who does not have access to the speech time, the local evaluation time of tenses embedded in PACs cannot be the speech time. This semantic constraint limits possible cross-linguistic variation in the interpretation of tenses embedded in PACs. By contrast, TACs are just adverbial clauses that restrict the denotation of the matrix clause. Unlike PACs, TACs do not impose semantic restrictions on how to determine the local evaluation time of the embedded clause, and there is cross-linguistic variation in this respect.

## 3.1 Variation in temporal adjunct clauses (TACs)

Recall from §2 that the past tense occurs in English and Russian ‘before’-TACs (with a past tense matrix clause) whereas the non-past tense occurs in the Japanese counterparts. This variation can be accounted for semantically by allowing for variation in what time a temporal connective of a particular language specifies as the local evaluation time of the embedded tense. This is illustrated in detail in Kubota et al. (2009). For Japanese, we follow Ogihara (1994, 1996), who derives the distribution of tenses in TACs from the meanings of tenses and temporal connectives. Consider (7-a) and its translation in (7-b), where past is the contribution of the matrix clause past tense and npst that of the embedded non-past tense.\(^6\)

\begin{align*}
(7) \text{a.} & \quad [\text{Ken-ga ku-ru mae-ni}] \text{ Anna-ga kaet-ta.} \quad \text{(Japanese)} \\
& \quad \text{Ken-NOM arrive-NPST before-at Anna-NOM leave-PAST} \\
& \quad \text{‘Anna left before Ken arrived.’} \\
(7) \text{b.} & \quad \exists t [\text{past}(t) \land \text{AT}(t, \text{leave}^\prime(a)) \\
& \quad \land \text{AT}(t, \exists t_1 [\text{npst}(t_1) \land \text{AT}(t_1, \text{arrive}^\prime(k)) \land t < t_1])]
\end{align*}

---

\(^5\)The idea that a time (potentially) distinct from the speech time is useful for the interpretation of embedded tenses is also present in e.g. Gennari (2003) on English, Ogihara (1996) on Japanese (and English), Yoon (1996) on Korean and Smirnova (2009) on Bulgarian.

\(^6\)\([\text{past}(\zeta)]^{M,i,g} = 1 \iff [\zeta]^{M,i,g} < i; [\text{npst}(\zeta)]^{M,i,g} = 1 \iff i \leq [\zeta]^{M,i,g}\).
According to (7-b), (7-a) is true if and only if there is a time \( t \) prior to the speech time \( s^* \) at which Anna leaves (contribution of the matrix past tense) and there is a time \( t_1 \) that is non-past with respect to \( t \) and at which Ken arrives (contribution of the embedded non-past tense), and \( t \) precedes \( t_1 \) (contribution of the connective \( mae \) ‘before’). The time \( t \) is located prior to the speech time since the local evaluation time of the matrix clause past tense is the speech time \( s^* \). The local evaluation time for the embedded tense, however, is the matrix event time \( t \) as specified by the AT predicate. Therefore, the embedded non-past tense locates the time \( t_1 \) of Ken’s arrival at or in the future of the time \( t \) of Anna’s leaving. Since the temporal connective requires \( t \) to precede \( t_1 \), it is correctly predicted that (7-a) means that Anna left before Ken arrived. The key to this analysis is the lexical entry of the temporal connective \( mae \) ‘before’: it specifies (using the AT predicate) that the local evaluation time of the embedded clause \( P \) is the event time \( t \) of the matrix clause \( Q \):

\[
(8) \quad mae \text{ ‘before’} \Rightarrow \lambda P \lambda Q \lambda t \left[ Q(t) \land AT(t, \exists t_1 [P(t_1) \land t < t_1)] \right]
\]

This analysis (originally due to Ogihara) also predicts that the past tense is unacceptable in Japanese ‘before’ clauses since a contradiction arises between the interpretation of the embedded past tense (which locates \( t_1 \) prior to \( t \) and the interpretation of the temporal connective (which requires that \( t \) precede \( t_1 \)):

\[
\begin{align*}
\text{(9a)} & \quad \# [\text{Ken-ga ki-ta mae-ni}] \text{ Anna-ga kaet-ta. (Japanese)} \\
& \text{Intended: ‘Anna left before Ken arrived.’} \\
\text{(9b)} & \quad \exists t [\text{past}(t) \land AT(t, leave'(a)) \\
& \quad \land AT(t, \exists t_1 [\text{past}(t_1) \land AT(t_1, arrive'(k)) \land t < t_1])]
\end{align*}
\]

We do not follow Ogihara in his analysis of English TACs, which, as discussed in §4, relies on syntactic differences between English and Japanese. Instead, we account for the distribution of tenses in English and Russian TACs by specifying that the local evaluation time of the embedded clause is the speech time rather than the matrix event time (cf. Stump (1985) for English). (10) gives the relevant lexical entries for the temporal connectives:

\[
(10) \quad \text{English before/Russian pered ‘before’} \Rightarrow \lambda P \lambda Q \lambda t \left[ \exists t_1 (Q(t) \land P(t_1) \land t < t_1) \right]
\]

In contrast to the lexical entry of Japanese ‘before’ in (8), the denotation of the embedded clause (again, represented by the variable \( P \)) is not embedded under an AT predicate in (10). Thus, the local evaluation time of the embedded clause is the speech time. This correctly predicts that the past tense is acceptable in English and Russian ‘before’-TACs, as illustrated in (11) for English:

---

7The AT predicate is defined as: \([AT(\zeta, P)]_M \neq M_{t, g} \iff [P]_M \neq [\zeta]_{M_{t, g}}\)

8As it stands, the analysis incorrectly predicts there is a time at which the eventuality denoted by a ‘before’-clause is true, i.e. that the ‘before’-clause is veridical. We assume that our analysis can be adapted along the lines of Beaver and Condoravdi (2003) to account for the non-veridical readings of ‘before’-TACs.
(11) a. Anna left before Ken arrived.
b. ∃t∃t_1 [past(t) ∧ AT(t, leave'(a)) ∧ past(t_1) ∧ AT(t_1, arrive'(k)) ∧ t < t_1]

According to (11-b), (11-a) is true if and only if there is a time t in the past of the speech time at which Anna leaves and a time t_1 in the past of the speech time at which Ken arrives, and t precedes t_1.

In sum, we account for cross-linguistic variation in English, Japanese and Russian TACs semantically. Our analysis is a synthesis (and modest extension) of Ogihara’s (1994, 1996) relative tense analysis of Japanese TACs and Stump’s (1985) absolute tense analysis of English TACs. (Cf. Kubota et al. (2009) for a rebuttal of Ogihara’s criticism of a Stump-style analysis of English TACs.) Crucially, TACs themselves do not impose any constraint on how the local evaluation time of the embedded clause should be identified, thus allowing for variation such as that observed with English and Russian versus Japanese.

3.2 Variation in propositional attitude complements (PACs)

In contrast to TACs, the semantics of PACs imposes a constraint on the interpretation of embedded tense. More specifically, due to the fact that PACs express a mental attitude held by an individual who does not necessarily have access to the utterance event in which his/her mental attitude is reported, PACs cannot in principle contain indexical expressions that refer to the speech time (cf. e.g. von Stechow 1995; Ogihara 1996). What this means with respect to tenses occurring inside PACs is that they can’t have interpretations that make reference to the speech time; in other words, setting the local evaluation time to the speech time is not an option for tenses inside PACs. Instead, tenses in PACs are interpreted with respect to the time that the attitude holder takes to be the current time. We call this time the ‘attitude holder’s now’, adapting Abusch’s (1997b) term ‘believer’s now’. Since this property of PACs is a consequence of what it means to ascribe a mental attitude to some individual, this is a constraint that any language observes:

(12) The ‘attitude holder’s now’ is identified with the local evaluation time of the PAC (von Stechow 1995; Abusch 1997b; Gennari 2003).

It follows from (12) that, cross-linguistically, the local evaluation time of a PAC invariably is the matrix event time (in the belief worlds of the attitude holder). Thus, an embedded past tense locates the eventuality denoted by the embedded clause at a time prior to the time of the matrix event whereas an embedded non-past tense locates it at (or after) the matrix event time. This is the pattern observed in §2 for Japanese and Russian PACs. Consider the Japanese examples in (13-a) and (14-a), together with their translations:\(^{9}\)

\(^{9}\)We assume that PACs denote propositions (sets of world-time pairs), such that e.g. for an individual to believe the proposition p in w at i is to say that for all of the pairs of w’ and t’ that could be the actual world and the current time according to this individual’s belief in w at i, p is true in w’ at t’.
Ken-TOP Anna-NOM sick be-PAST COMPL believe-PAST
‘Ken believed that Anna had been sick.’
b.  $\exists t [A T(t, believe' (k, ^{\wedge} \exists t' [A T(t', sick' (a)) \wedge past(t')]) \wedge past(t)]$

Ken-TOP Anna-NOM sick be.NPST COMPL believe-PAST
‘Ken believed that Anna was sick (at the time of his belief).’
b.  $\exists t [A T(t, believe' (k, ^{\wedge} \exists t' [A T(t', sick' (a)) \wedge npst(t')]) \wedge past(t)]$

(13-a) is true if and only if there is some time $t$ prior to the speech time at which Ken believes that there is some time $t'$ prior to the time of his utterance at which Anna is sick.
(14-a) is true if and only if there is some time $t$ prior to the speech time at which Ken believes that there is some time $t'$ not prior to the time of his utterance at which Anna is sick. This analysis of Japanese PACs is essentially that of Ogihara (1989, 1996). The same semantic analysis accounts for Russian PACs.

English seems to pose a problem for this analysis of PACs: If no cross-linguistic variation with respect to the identity of the local evaluation time is allowed in PACs, why is it that English does not pattern like Japanese and Russian? Recall that English PACs embedded under a past tense matrix clause differ from Japanese/Russian ones in two ways: First, English past tense stative PACs may receive both an overlapping and a back-shifted interpretation; second, non-past PACs receive a double-access interpretation. We follow Gennari (1999, 2001, 2003) in assuming that these two facts are not independent: in short, her insight is that English past tense stative PACs are compatible with a wider set of interpretations than their Japanese/Russian counterparts because of the fact that English non-past PACs receive a double-access rather than a simple overlapping interpretation. Gennari proposes that the English non-past tense in PACs is exceptional compared to other English tenses and tenses in other languages in that it is both indexical and anaphoric: it is indexical since it refers to the speech time and it is anaphoric since it also imposes a constraint on the relation between the event time and the evaluation time.

Adopting Gennari’s (1999) analysis, the meaning of $\text{npst}_E$, the English non-past tense in PACs, can be defined as follows:¹⁰

$$\lbrack \text{npst}_E(\zeta) \rbrack^{M,i,g} = 1 \text{ iff } \lbrack \zeta \rbrack^{M,i,g} \cap I \neq \emptyset \text{ and } \lnot (\lbrack \zeta \rbrack^{M,i,g} \perp s^*)$$

This definition contains a direct reference to the speech time by means of the distinguished free variable $s^*$. As a consequence, English examples with non-past tense PACs, like (16-a), should, strictly speaking, be semantically uninterpretable given the constraint in (12): the problem is that the translation in (16-b) would ascribe to the attitude holder a mental attitude about a time whose location is unknown to her/him. More specifically, when interpreting the semantic contribution of the embedded non-past tense in (15), one

¹⁰Thus, the meaning of the English non-past tense realized in PACs differs from the non-past tense in TACs, cf. footnote 6.
cannot make sense of the $s^*$ designating the speech time as part of the belief attributed to the attitude holder.

(16)  
(a) Ken believed that Anna is sick.  
(b) $\exists t [\text{AT}(t, \text{believe}(k, \land \exists t_1 [\text{AT}(t_1, \text{sick}(a)) \land \text{npst}_E(t_1)]) \land \text{past}(t))]$

Gennari solves this problem by arguing that PACs (in English) do not directly denote mental attitudes held by the attitude holder, but rather that they denote ‘implicit attitudes’ — attitudes ascribed to attitude holders from the perspective of the reporter of the attitude. The idea is that when we talk about an attitude held by some individual, we are really talking about an augmented variant of the original attitude of the attitude holder with our own interpretation ‘superimposed’ on it, so to speak. We allow ourselves to talk as if the original attitude holder actually held that augmented variant of his/her own belief. Since the reporter of the attitude has access to the speech time, the ‘interpretation’ of the original attitude can of course make reference to the speech time. At the same time, since the non-past tense is interpreted with respect to the attitude holder’s now, the anaphoric part of the meaning of the non-past tense in PACs requires temporal overlap of the event times of the embedded and the matrix clause. Thus, Gennari’s analysis correctly captures native speakers’ intuitions that a sentence like (16-a) is infelicitous if, for example, it was uttered a month after Ken had a belief that Anna was sick but he also believed that she would get better in a week. One of the only requirements that need to be satisfied for (16-a) to be uttered felicitously is that a reasonable interpretation of Ken’s belief be such that he would have accepted as also believing that Anna would be sick at the speech time had he been demanded to explicate his belief more precisely at the time he held that belief. Thus, in Gennari’s analysis, (16-a) is true if Ken at some past time held the belief that Anna was sick at that time and the reporter of Ken’s attitude has reason to believe that Ken would also have believed that Anna would be sick at the speech time.

Gennari’s (2003) key insight is that the fact that English non-past PACs receive an unexpected interpretation has repercussions for the interpretation of English past tense PACs. She argues that English past tense stative PACs can receive an overlapping interpretation (in contrast to those of Japanese and Russian) since English non-past PACs like (16-a) cannot express a purely overlapping interpretation, i.e. one where Anna is sick at the past time of Ken’s belief but not necessarily at the speech time. Gennari’s analysis makes use of the superinterval property,11 a pragmatic inference available for states (but not events) according to which a stative proposition is implicated to be true at a proper super-interval of the interval for which it is asserted to be true (Dowty 1986). Gennari accounts for the overlapping interpretation of past under past English PACs as follows. In English (just as in Japanese and Russian), the truth-conditional meaning of a past tense embedded in a PAC gives rise to the back-shifted interpretation. The interval at which a past tense stative PAC is true may be implicated to be a larger interval, one that includes the attitude holder’s now, such that past tense stative PACs may receive an

11A stative proposition, due to its homogeneity, has the entailment that it is true of all of the subintervals $I'$ of an interval $I$ at which it is true. Thus, for any of the subintervals $I'$ there is a proper super-interval at which the proposition is true. But then, given any interval at which a stative proposition is true, it is implicated that there is a (proper) super-interval at which the proposition is also true.
overlapping interpretation. This implicature arises in English since the overlapping interpretation is unavailable in English with an embedded non-past tense; the overlapping reading is blocked for Japanese and Russian past under past PACs since a non-past PAC realizes this meaning. Gennari’s analysis also predicts that the overlapping interpretation is not available for past tense eventive PACs since eventive predicates do not have the superinterval property (but see Kusumoto (1999), who argues that the overlapping interpretation is available with some eventive predicates).

In sum, Gennari (1999, 2003) shows that the seemingly anomalous interpretations of English past and non-past PACs can be systematically explained once the relevant factors (Aktionsart, tense) are teased apart carefully. This means that we can maintain our thesis that the local evaluation time of PACs is uniformly the attitude holder’s now. Cross-linguistic variation in the interpretation of tense in PACs is not variation in how the local evaluation time of an embedded tense is set but rather results from the existence of an exceptional tense (such as the English non-past) whose meaning does not involve just the local evaluation time but also an indexical reference to the speech time.

3.3 Summary

We have provided a purely semantic analysis of cross-linguistic variation in the distribution and interpretation of tenses in PACs and TACs in English, Japanese and Russian. Crucial to the analysis is the observation that PACs but not TACs impose constraints on how the local evaluation time is determined. The cross-linguistic variation in the distribution of tenses in TACs can then be attributed to the fact that the local evaluation time can be either the speech time or the matrix event time. In PACs, on the other hand, the local evaluation time is always the matrix event time; variation nevertheless arises from differences in tense systems.

A consequence of our analysis is that all tenses are anaphoric, i.e. interpreted with respect to the local evaluation time (the English non-past tense in PACs additionally is indexical). Differences in how tenses are interpreted do not arise from the meaning of the tenses themselves but rather from the way in which the local evaluation time is set by constructions in which tenses occur. This stands in contrast to the traditional absolute/relative classification of tenses where differences in interpretation seem to be attributed to the tenses themselves (cf. §2). A conceptual advantage of the former way of characterizing cross-linguistic variation in tense systems is that e.g. the tenses of Russian are unproblematic. Recall that, under the traditional characterization, data from TACs motivated that Russian tenses are absolute while PACs motivated that Russian tenses are relative. In our approach, Russian tenses are uniformly anaphoric—what differs is that the local evaluation time is the speech time in TACs and the matrix event time in PACs. Thus, we argue that the traditional classification of tenses as absolute or relative is merely an epiphenomenon of differences in the identity of the local evaluation time across languages and constructions.
4 Comparison with previous proposals

In this section we compare our semantic analysis of the variation to that of Ogihara (1989, 1996, 1994) and Arregui and Kusumoto (1998).


Ogihara is concerned with variation in English and Japanese PACs and TACs. As discussed above, we adopt his analysis of Japanese TACs and PACs, according to which the local evaluation time of the embedded tense is the matrix event time. Our proposal differs from his in how English TACs and PACs are interpreted. For English TACs, Ogihara assumes that the local evaluation time of embedded tenses is the matrix event time, too, just like in Japanese. To account for the observed variation between English and Japanese, Ogihara relies on the Sequence-of-Tense (SOT) rule, which operates at Logical Form (LF) and deletes an embedded tense that is c-commanded by an identical matrix tense. He assumes that this rule does not apply in Japanese TACs or PACs (where embedded tenses are always interpreted at the matrix event time) but applies obligatorily in English TACs. Thus, past tense before-clauses are acceptable in English since the backward shifting contribution of the past tense is eliminated by the SOT rule.

Ogihara also relies on the SOT rule to account for the interpretations of past tense PACs with past matrix clauses. In contrast to TACs, the SOT rule applies optionally in PACs: a past tense PAC in English receives a back-shifted interpretation if the SOT rule does not apply and an overlapping interpretation if the SOT rule applies. Ogihara (1996) accounts for the double-access interpretation of non-past tense PACs (with past matrix clauses) by assuming that the embedded non-past tense is interpreted de re, i.e. outside the scope of the attitude verb in the matrix clause (cf. also Abusch 1997b for a closely related approach). The translation of the structure that results after the embedded non-past tense has moved is given in (17-a), cf. Ogihara (1996, 212). The sentence Ken believed that Anna is sick receives the translation in (17-b):

\[
(17) \begin{align*}
\text{a.} & \quad \lambda t_3 \lambda t_2 \exists s_n[\text{pres}_n(t_2)(t_3) \land \text{exist}'(t_2)(s_n) \land \exists t_5(S(s^*)(t_5))] \\
\text{b.} & \quad \exists s[\text{exist}'(s^*,s) \land \exists t(t < s^' \land \text{believe}'(t,k,s) \land \lambda t_3 \lambda s_1[\text{sick}'(s_1,a)])]]
\end{align*}
\]

According to (17-b) and the truth conditions Ogihara proposes for de re attitude verbs, Ken believed that Anna is sick is true if and only if there exists a state \( s \) that includes the speech time \( s^* \) and there is an acquaintance relation \( R \) that connects Ken to \( s \) in the actual world at the past time \( t \), and, in all of Ken’s doxastic alternatives \( \langle w', t' \rangle \) in the actual world \( w \) and at \( t \), the state to which Ken is acquainted via \( R \) in \( w' \) at \( t' \) has the property of Anna being sick. Hence, the acquaintance relation and the meaning of believe defined in terms of it account for the temporal overlap of \( s \) with the matrix event time \( t \), whereas the overlap of \( s \) with the speech time is contributed by the exist’ predicate, which comes from the definition of the de re non-past tense in (17-a).

Ogihara’s analysis of cross-linguistic variation in English and Japanese TACs and PACs faces both empirical and conceptual problems:

1. Since the SOT rule applies at the level of LF, Ogihara’s analysis can only be couched in theories that have a syntactic level of representation at which c-command is definable and deletion operations are permissible.
2. Ogihara’s analysis of PACs treats as separate and unrelated phenomena the fact that English past under past PACs may receive an overlapping interpretation and the fact that non-past under past PACs receive the double-access interpretation. Thus, in contrast to Gennari, Ogihara does not predict that only if a language induces double-access readings for the non-past tense can past under past PACs receive an overlapping interpretation.\footnote{Recall that, in Gennari’s analysis, the latter fact is a consequence of the former. To account for this fact in the context of an analysis of PACs along the lines of Ogihara (1996), one would need to introduce an additional mechanism such as Sharvit’s (2003) Embeddability Principle.}

3. It is unclear whether Ogihara’s analysis extends to languages such as Russian. Arregui and Kusumoto (1998) point out that Polish (which is like Russian in all relevant respects) behaves like English with respect to TACs but like Japanese with respect to PACs. Thus, if one assumes (as is the null hypothesis in an SOT-based account) that a language either has the SOT rule or does not have it, Ogihara’s analysis cannot be extended to Polish and Russian. (See Kubota et al. (2009) for further discussion of this point.)

4. As pointed out by Gennari (1999, 2003) it remains unclear under Ogihara’s account why the overlapping interpretation of past under past PACs and the double-access reading is only available for embedded stative predicates (whereas this falls out naturally from Gennari’s analysis).

5. Gennari (1999, 2003) provides several arguments against \textit{de re} analyses of the double-access interpretation. For example, as Gennari (1999) shows, for a sentence with a double-access reading to be felicitous, there does not necessarily have to be any state of affairs that obtains throughout an interval containing both the embedded event time and the speech time in the actual world. Ogihara’s analysis, however, as well as that of Abusch (1997b), require the existence of such an interval.

### 4.2 Arregui and Kusumoto (1998)

Arregui and Kusumoto (1998) (henceforth A&K) analyze variation among English, Japanese and Polish TACs (where Polish behaves like Russian in the relevant respects). We refer the reader to Kubota et al. (2009) for detailed comparison of our analysis with A&K. The central assumption of A&K’s analysis is that English and Polish TACs have a different syntactic structure than Japanese TACs; in particular, the temporal connectives of English and Polish TACs select for a CP while that of Japanese selects for a TP. Since the speech time is assumed to be realized in the head of CP, a consequence of the syntactic variation is that English and Polish tenses in TACs are interpreted with respect to the speech time while that of Japanese TACs are interpreted with respect to the matrix event time. This correctly predicts that, with past tense matrix clauses, the past tenses occur in English and Polish TACs (cf. (4-a) and (4-c)) while Japanese TACs require the non-past tense (4-b).

As discussed by A&K, these syntactic differences do not suffice to exclude the past tense from Japanese \textit{mae} ‘before’ clauses. To remedy the situation, A&K propose that Japanese \textit{mae} ‘before’ bears a binder index and, hence, can occur with a
present tense (a variable), but not with past tense (a temporal abstract modifier of type \(\langle\langle i,t \rangle, \langle i,t \rangle\rangle\)). Thus, in short, the analysis of the cross-linguistic variation in TACs proposed by A&K relies on a non-uniform syntax/semantics of the temporal connectives in Japanese, as well as a non-uniform syntax/semantics of the past and non-past tenses of the three languages.

5 Conclusion

Cross-linguistic analyses of the distribution and interpretation of tenses embedded in TACs and PACs sit squarely at the interface of the syntactic and semantic components of grammar. These analyses differ in the extent to which they attribute the variation to syntactic or semantic similarities and differences between languages. The comparison of previous analyses of (parts of) the variation to the semantic analysis developed in §3 has shown that, all other things being equal, the semantic analysis is more straightforward since it only relies on the semantic contributions of the expressions and constructions involved. By contrast, Oghara’s and A&K’s analyses involve syntactic differences between the languages, e.g. with respect to the tenses, the structure of TACs or the interface with semantics. We maintain that a semantic analysis of a semantic phenomenon (tense interpretation) is generally preferable. Additionally, we conclude that the semantic analysis of the variation is not only a viable alternative to the previous, syntactic analyses but advantageous for empirical, conceptual and theoretical reasons.

References


Spanish *Unos* and the Article Hypothesis

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Abstract

The main claim of this paper is that *unos* is the Spanish plural indefinite article. This claim will be motivated both from a diachronic and a synchronic perspective. I will furthermore motivate why indefinite articles are expected to lack partitive readings and bare nominal arguments needn’t be blocked by the existence of an article (cf. Chierchia’s Blocking Principle)

1 Introduction: the challenge

Spanish has a plural determiner that doesn’t allow for proportional readings: *unos* ‘some’ (Villalta 1994, Gutiérrez-Rexach 2001, Martí 2008). The challenge resides in the fact that non-proportional determiners in general do have a proportional use that surfaces when they are stressed. As shown in (1) *unos* is a noteworthy exception to this generalization:

\begin{align*}
(1) \ ? \ UNOS \ \text{estudiantes} \ & \text{son} \ \text{abogados}. \\
& \text{some students are lawyers} \\
& \text{“SOME students are lawyers.”}
\end{align*}

(Gutiérrez-Rexach 2001)

Even though this behaviour of *unos* has often been described in the literature there has only been one attempt to explain why *unos* behaves this way: Martí (2008) opposes *unos* to *algunos* ‘some’ and hypothesizes that *alg-* adds a syntactic / semantic layer responsible for the availability of proportional readings. This however begs the question why only *unos* needs *alg-* for this.

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\footnote{Note that I am aware of the fact that *unos* can take partitive readings when combined with *otros*. I however assume, with Gutiérrez-Rexach (2001) and Martí (2008) that *unos*…*otros* is a fixed expression.}
2 My proposal

I claim *unos* is the Spanish plural indefinite article. The initial motivation for this proposal comes from the fact that in the singular determiner paradigm indefinite articles are in general the only ones that do not allow for partitive readings:

(2) ? A student is a lawyer. (non-generic reading)

Before addressing two of the questions this claim raises I will take a look at corroborating evidence from diachrony. This is the topic of section 3.

3 Support from diachrony

In 2. I showed that *unos* patterns (at least partially) with indefinite singular articles in synchrony. In this section I will show that it also patterns with them in diachrony. To do so I will look at two properties that can be associated with the grammaticalization process that gives rise to indefinite articles. It is important to note that I will talk about those indefinite articles that originated in the numeral *one*.

3.1 Semantic bleaching

Even though it is never explicitly mentioned the evolution from a numeral to an indefinite article involves semantic bleaching: whereas the numeral does allow for partitive readings, the indefinite article does not. This means that somewhere along their grammaticalization path numerals lose their partitive potential.

If *unos* behaves like indefinite articles in diachrony we expect it to have allowed for partitive readings at the beginning of its grammaticalization process. Showing that this expectation is borne out is not straightforward though. Indeed, given that we have no access to native speaker judgements for Old Spanish it is hard to tell whether the occurrences of *unos* we find have a partitive reading or not. There is a way out though; it has been claimed that one of the ramifications of *unos*’ incapacity to allow for partitive readings in synchrony is that it cannot appear in the upstairs D position of (standard) partitives (Gutiérrez-Rexach 2001):

(3) ??? He visto a unos de los familiares de Pedro
have seen to some of the relatives of Pedro

Intended: ‘I saw some of Pedro’s relatives.’

(Gutiérrez-Rexach 2001)

Under the assumption that the same should hold in diachrony this gives us a tool to probe the partitive potential of *unos* without having to worry too much about the intended interpretation.
On a first browse through the data of the CORDE corpus I came up with the following example:  

(4) E ellas yendo, se fueron unos de los guardadores  
    And they going themselves went some of the guards  
    a la ciudad  
    to the city  
    "And while they left, some of the guards went to the city."

It is taken from the Manuscrito Escurialense – an Old Spanish Bible manuscript (of around 1260) – and refers to the events that took place on the day Mary and the other women discovered that Jesus’ grave was empty. The crucial thing to note is that unos appears as the upstairs determiner of a partitive; the interpretation of this example is that some but not all of the guards went to the city (to tell the High Priests what happened).

Convincing as this example might seem it of course does not warrant the conclusion that unos allowed for partitive readings at the beginning of its grammaticalization process. Indeed, two potential problems have to be discarded before this conclusion can be drawn. The first is one every corpus study faces: if you only have one example it might actually be an accident. This is further complicated by the fact that any text could contain an accident. What I should be looking for then is texts with multiple examples. The second problem is more subtle: the example in (4) is drawn from a translation and it is not unthinkable that the translator did not respect the grammar of his / her language in order to try to be faithful to the original text. To discard this problem I have to compare the translation to the original text.

The first problem can easily be solved. A more profound browse of the CORDE corpus shows that there are three texts with multiple occurrences of unos in the upstairs D position of partitives:

<table>
<thead>
<tr>
<th>text</th>
<th>author</th>
<th>number of partitives with unos</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manuscrito Escurialense (1260)</td>
<td>Anonymous</td>
<td>8</td>
</tr>
<tr>
<td>General Estoria (1270)</td>
<td>Alfonso X</td>
<td>5</td>
</tr>
<tr>
<td>Biblia Reina-Valera (1570)</td>
<td>Casiodoro de Reina</td>
<td>6</td>
</tr>
</tbody>
</table>

This not only shows that the example in (4) is not isolated within Old Spanish but moreover that it is not isolated within one text.

I now turn to the second problem that has become more acute than before given that two of the texts listed in (5) are translations (the Manuscrito Escurialense and the Biblia Reina-Valera). In order to show that the original texts did not influence the translations I will show that identical constructions in the original text not only gave rise to translations involving unos but also to translations involving algunos. This shows the translator had an alternative and did not hesitate to use it. The hypothesis

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2 CORDE stands for COrpus Diacrónico del Español, is maintained by the Real Academia Española and is freely available online (http://corpus.rae.es/cordenet.html).
that he would have used *unos* to be faithful to the original text is thus effectively discarded.

In Table 1 I compare the Manuscrito Escurialense to its original which is assumed to be the Vulgate (the latin translation by Saint Jerome). The table is organized in the following way: in the third column I list the constructions of the original text giving rise to a partitive construction with *unos* or *algunos* in the translation. The fourth column indicates whether *unos* or *algunos* were used.³

<table>
<thead>
<tr>
<th>Reference</th>
<th>Vulgata</th>
<th>Manuscrito Escurialense</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Romans 11:17</td>
<td><em>aliqui</em> + <em>ex</em> + plural</td>
<td><em>unos</em></td>
</tr>
<tr>
<td>2 John 9:40</td>
<td><em>ex</em> + plural</td>
<td><em>algunos</em></td>
</tr>
<tr>
<td>3 Matthew 9:3</td>
<td><em>quidam</em> + <em>de</em> + plural</td>
<td><em>algunos</em></td>
</tr>
<tr>
<td>4 Matthew 12:38</td>
<td><em>quidam</em> + <em>de</em> + plural</td>
<td><em>unos</em></td>
</tr>
<tr>
<td>5 Matthew 28:11</td>
<td><em>quidam</em> + <em>de</em> + plural</td>
<td><em>unos</em></td>
</tr>
<tr>
<td>6 Mark 2:6</td>
<td><em>quidam</em> + <em>de</em> + plural</td>
<td><em>algunos</em></td>
</tr>
<tr>
<td>7 Mark 15:35</td>
<td><em>quidam</em> + <em>de</em> + plural</td>
<td><em>algunos</em></td>
</tr>
<tr>
<td>8 Luke 24:24</td>
<td><em>quidam</em> + <em>ex</em> + plural</td>
<td><em>unos</em></td>
</tr>
<tr>
<td>9 Acts 15:2</td>
<td><em>quidam</em> + <em>ex</em> + plural</td>
<td><em>algunos</em></td>
</tr>
<tr>
<td>10 Acts 23:12</td>
<td><em>quidam</em> + <em>ex</em> + plural</td>
<td><em>unos</em></td>
</tr>
<tr>
<td>11 Luke 6:2</td>
<td><em>quidam</em> + <em>genitive</em> plural</td>
<td><em>algunos</em></td>
</tr>
<tr>
<td>12 Luke 13:31</td>
<td><em>quidam</em> + <em>genitive</em> plural</td>
<td><em>unos</em></td>
</tr>
<tr>
<td>13 Luke 20:27</td>
<td><em>quidam</em> + <em>genitive</em> plural</td>
<td><em>unos</em></td>
</tr>
<tr>
<td>14 Luke 20:39</td>
<td><em>quidam</em> + <em>genitive</em> plural</td>
<td><em>unos</em></td>
</tr>
<tr>
<td>15 Acts 23:9</td>
<td><em>quidam</em> + <em>genitive</em> plural</td>
<td><em>unos</em></td>
</tr>
<tr>
<td>16 Mark 12:13</td>
<td><em>quosdam</em> + <em>ex</em> + plural</td>
<td><em>algunos</em></td>
</tr>
</tbody>
</table>

Table 1: Comparison between Manuscrito Escurialense and Vulgate

What Table 1 shows is that for none of the latin partitive constructions that are recurrent it is possible to predict how it will be translated; both *algunos* and *unos* appear in their translations. It furthermore shows that *unos* is as productive in the translation of partitives as *algunos*; both *unos* and *algunos* are chosen 50 percent of the time. This strongly suggests that the partitive potential of *unos* was comparable to that of *algunos*.

In Table 2 I compare the Biblia Reina-Valera to its original which is assumed to be the Textus Receptus (a Greek translation of the bible by Stephanus dating back to 1550).⁴ The table is organized in the same way as Table 1.⁵

What Table 2 shows is that for the only recurrent Greek construction it is not possible to predict how it will be translated; both *algunos* and *unos* appear in its translations. It is interesting to note though that *unos* is far less frequent than *algunos* especially in comparison to what we saw for the Manuscrito Escurialense. This is in no

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³ I used the edition of the Vulgate that is freely available online via [http://www.biblegateway.com](http://www.biblegateway.com).

⁴ I used the edition of the Reina-Valera bible that is freely available online via [http://www.biblegateway.com](http://www.biblegateway.com).

⁵ Note that there is one partitive construction involving *unos* that is missing in the table. This is due to the fact that the original construction was not a partitive construction.
way surprising though; under the assumption that *unos* started to grammaticalize time should have an influence on its partitive potential. Given that the Biblia Reina-Valera is roughly three hundred years younger than the Manuscrito Escurialense it would even be weird if *unos* were to be chosen as frequently as *algunos*.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Textus Receptus</th>
<th>Reina-Valera</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Mark 12:13</td>
<td><em>tinas</em> + genitive definite plural</td>
<td><em>algunos</em></td>
</tr>
<tr>
<td>2 Acts 21:16</td>
<td>genitive definite plural</td>
<td><em>algunos</em></td>
</tr>
<tr>
<td>3 Acts 19:13</td>
<td><em>tines</em> + <em>apo</em> + definite plural</td>
<td><em>algunos</em></td>
</tr>
<tr>
<td>4 John 7:25</td>
<td><em>tines</em> + <em>ek</em> + definite plural</td>
<td><em>unos</em></td>
</tr>
<tr>
<td>5 Matthew 9:3</td>
<td><em>tines</em> + genitive definite plural</td>
<td><em>algunos</em></td>
</tr>
<tr>
<td>6 Matthew 12:38</td>
<td><em>tines</em> + genitive definite plural</td>
<td><em>algunos</em></td>
</tr>
<tr>
<td>7 Mark 2:6</td>
<td><em>tines</em> + genitive definite plural</td>
<td><em>algunos</em></td>
</tr>
<tr>
<td>8 Mark 7:1</td>
<td><em>tines</em> + genitive definite plural</td>
<td><em>algunos</em></td>
</tr>
<tr>
<td>9 Mark 11:5</td>
<td><em>tines</em> + genitive definite plural</td>
<td><em>unos</em></td>
</tr>
<tr>
<td>10 Mark 15:35</td>
<td><em>tines</em> + genitive definite plural</td>
<td><em>unos</em></td>
</tr>
<tr>
<td>11 Luke 6:2</td>
<td><em>tines</em> + genitive definite plural</td>
<td><em>algunos</em></td>
</tr>
<tr>
<td>12 Luke 9:27</td>
<td><em>tines</em> + genitive definite plural</td>
<td><em>algunos</em></td>
</tr>
<tr>
<td>13 Luke 19:39</td>
<td><em>tines</em> + genitive definite plural</td>
<td><em>algunos</em></td>
</tr>
<tr>
<td>14 Luke 20:27</td>
<td><em>tines</em> + genitive definite plural</td>
<td><em>unos</em></td>
</tr>
<tr>
<td>15 Luke 20:39</td>
<td><em>tines</em> + genitive definite plural</td>
<td><em>unos</em></td>
</tr>
<tr>
<td>16 Luke 24:24</td>
<td><em>tines</em> + genitive definite plural</td>
<td><em>algunos</em></td>
</tr>
<tr>
<td>17 Acts 10:23</td>
<td><em>tines</em> + genitive definite plural</td>
<td><em>algunos</em></td>
</tr>
<tr>
<td>18 Acts 19:31</td>
<td><em>tines</em> + genitive definite plural</td>
<td><em>algunos</em></td>
</tr>
<tr>
<td>19 Acts 23:12</td>
<td><em>tines</em> + genitive definite plural</td>
<td><em>algunos</em></td>
</tr>
<tr>
<td>20 Romans 11:17</td>
<td><em>tines</em> + genitive definite plural</td>
<td><em>algunos</em></td>
</tr>
</tbody>
</table>

Table 2: Comparison between Textus Receptus und Reina-Valera

From the above I conclude that *unos* allowed for partitive readings at the beginning of its grammaticalization process. Given that it doesn’t allow for them anymore and given that the same evolution holds for indefinite articles I furthermore conclude that *unos* patterns (in this respect) with indefinite articles in diachrony. This is the first piece of evidence I draw from diachrony that corroborates my claim about the nature of *unos*.

### 3.2 Frequency

A well-attested fact about items that grammaticalize is that their frequency increases. This is no different for the indefinite article as is shown in Table 3 for its variants *un* and *una*. The data are taken from the Corpus del Español. Most noteworthy is the sudden increase in frequency around the 15th-16th century.

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6 The Corpus del Español was designed by Mark Davies, is maintained through the support of the National Endowment for the Humanities and Brigham Young University and is freely available online (http://www.corpusdelespanol.org/).
Table 3: Frequency of un / una

Under the assumption that *unos* behaves like indefinite articles in diachrony we expect it to have a similar increase in frequency around the same time. Table 4 shows that this expectation is borne out.

Table 4: Frequency of unos / unas

The frequency data show that *unos* patterns (in this respect) with indefinite articles in diachrony. This is the second piece of evidence I draw from diachrony that corroborates my claim about the nature of *unos*. 
3.3 Taking stock

In this section I have shown that *unos* patterns with indefinite articles in diachrony in at least two respects: (i) it lost its ability to take on partitive readings, (ii) its frequency increased dramatically around the same time as that of the indefinite article.\(^7\) The similarity is striking and I consider it to be strong support for my claim about the article status of *unos* especially when combined with the synchronic similarity noted in (1) and (2).

In the following section I will consider two of the questions my claim raises.

4 Two questions\(^8\)

4.1 What is an article?

In (1) and (2) I noted that *unos* patterns with singular indefinite articles in not allowing for partitive readings. This is a purely empirical observation and the real question that should be asked is the following: what is it that makes the lack of partitive readings of *unos* into an argument in favour of its articlehood? This question can be divided up into two subquestions: (i) what is an article? and (ii) why is it that articles do not allow for partitive readings?

The answer I propose for (i) goes back to Partee (1987): the indefinite singular article is the least marked inverse of the BE type-shift as defined in (6) (“it applies to a generalized quantifier, finds all the singletons therein, and collects their elements into a set”):

\[
\lambda \phi [\lambda x \{x \in \phi\}]
\]

The extension from a singular indefinite article to a plural one is straightforward: instead of having singular individuals we would be having plural individuals.

The answer I propose for (ii) finds its origin in the fact that the BE type-shift ignores any partitive structure: under the assumption that an indefinite article should be the inverse of BE one expects that it should not allow for structure that BE ignores.

---

\(^7\) I leave for future research the checking of a third possible similarity: it was noted by Blazer (1979) and Stark (2002) that articles – at the beginning of their grammaticalization process – marked highly persistent discourse referents. Under the assumption that *unos* behaves like indefinite articles in diachrony we would then expect it to have the same kind of use in the beginning of its grammaticalization process.

\(^8\) A question I don’t treat is why *unos* doesn’t allow for event-splitting (see Martí 2008). I leave this for future research but do acknowledge that it is potentially problematic for my analysis.
4.2 Why does Spanish allow for bare plural arguments?

Under the assumption that *unos* is the plural indefinite article we might expect the Blocking Principle in (8) to block the appearance of bare plurals in argument position. As shown in (9) this expectation is not borne out.

(8) Blocking Principle
For any type shifting operation $\tau$ and any $X$:
* $\tau(X)$
if there is a determiner $D$ such that for any set $X$ in its domain,
$D(X) = \tau(X)$

(Chierchia 1998)

(9) Juan comió bizcochos.
Juan ate biscuits
“Juan ate biscuits.”

The question (9) raises is whether I can maintain that *unos* is the plural counterpart of the indefinite article if it doesn’t pattern with it in blocking bare nominals. The answer I propose is that the facts in (9) are not a problem for my analysis of *unos* and that the Blocking Principle in (8) is too coarse-grained.

*The gist of my argumentation*

The strongest argument in favour of the Blocking Principle is the complementary distribution of bare singular arguments and indefinite / definite articles across languages. If we take this argument seriously and if it is possible to show that the bare plural and *unos* are in complementary distribution language-internally we can conclude that the Blocking Principle is not violated in (9) but that it needs to be qualified.

In what follows I will (i) identify the dimension along which I assume *unos* and the bare plural can be said to be in complementary distribution, (ii) show that they really are and (iii) give a revised version of the Blocking Principle.

*The dimension*

Laca & Tasmowski (1994) make an interesting observation: according to them the bare plural has to be replaced by *unos* if one wants to pick up its referent in subsequent discourse. This suggestion can be formally rendered in at least two ways. The first is that bare plurals cannot introduce discourse referents (see Laca 1996, 1999), the second that bare plurals introduce discourse referents that are not salient (i.e. that are not likely to be picked up in subsequent discourse). The choice between these ways can be settled empirically; if it is possible to refer back to a referent that could only have been introduced by a bare plural it is the salience card that has to be drawn. (10) shows that this is indeed the case.
(10) Encontró ladrones; pero no ladrones de buen tono, no ladrones fashionables como José María […]. Eran ladrones de poco más o menos […]. (La gaviota, Caballero Fernán)
He met thieves; but not thieves that are bon ton, not fashionable thieves like José María […]. They were thieves and nothing more […].

The dimension along which unos and the bare plural can be said to be in complementary distribution is that of salience: bare plurals introduce non-salient discourse referents whereas unos introduces salient discourse referents.

Complementary distribution
Showing a complementary distribution between two items on the basis of salience is not easy. Indeed, as Dayal (2004) notes for similar facts in Hindi, judgements “are affected by potentially different expectations people can have about the relevance of the entity referred to in the discourse”. There is a way to circumvent this problem though: if we can identify a context that prohibits the subsequent picking up of discourse referents and a context that forces the subsequent picking up of discourse referents we would make the predictions listed in (11). 9

(11) a. in a context that prohibits the picking up of discourse referents we expect the bare plural to be the only option
   b. in a context that forces the picking up of discourse referents we expect unos to be the only option

One context we know prohibits the picking up of discourse referents is the scope of negation. (11a) then predicts that unos has to scope over negation and function as a PPI. (12) shows that this prediction is borne out:

(12) A la reunión no asistieron unos profesores. NEG< unos *NEG> unos
At the meeting not attended some professors
“Some professors didn’t attend the meeting.” (Laca 1996)

The identification of a context forcing the picking up of discourse referents is more subtle and depends on a specific analysis of preverbal subjects in Spanish. Zagona (2002) (following work by Contreras (1991) and Olarrea (1996)) claims that Spanish preverbal subjects are adjuncts of a silent left dislocated clitic. The main argument in favour of this analysis is that there needn’t be grammatical agreement between a preverbal subject and its verb:

(13) Los estudiantes tenemos un alto concepto de nosotros mismos.
    The students have-1st-pl. a high opinion of us-pl.
    "Students, (we) have a high opinion of ourselves."

---

9 It would be more correct to talk about contexts that have an influence on the anaphoric potential of discourse referents that are introduced in them.
The disagreement between *los estudiantes* and *tenemos* can be explained if we assume a silent first person plural clitic that picks up the referent introduced by *los estudiantes*. Under this assumption *los estudiantes* has to be picked up by the silent clitic in order to be interpreted as the subject of the sentence and – more generally – to be interpretable within the sentence at all. This means that the preverbal subject position is one forcing the picking-up of discourse referent. (11b) then predicts that the bare plural should not be allowed to occur in this position. (14) shows that this prediction is borne out:

(14) * Políticos han ocupado el palacio.
    Politicians have occupied the palace
    “Politicians have occupied the palace.”

(Delfitto & Schroten 1991)

**Conclusion**

In what precedes I have shown that the bare plural and *unos* are in complementary distribution in Spanish w.r.t salience. If this language-internal observation is taken as seriously as the cross-linguistic observations that led to the formulation of the Blocking Principle this means that the Blocking Principle should be reformulated as follows:

(15) Blocking Principle (revised)
    For any type shifting operation τ and any X:
    *τ(X)
    if there is a determiner D such that for any set X in its domain,
    D(X) = τ(X)
    and the salience of D(X) is equal to that of τ(X)

    Under this revised version of the Blocking Principle the existence of bare plural arguments is no longer a problem for an analysis that assumes *unos* is the Spanish plural indefinite article.

5 **General conclusion**

The main claim of this paper is that *unos* is the Spanish plural indefinite article. This claim was motivated both from a diachronic and a synchronic perspective. I furthermore motivated why articles are expected to lack partitive readings and bare nominal arguments needn’t be blocked by the existence of an article.
Acknowledgements
This paper represents the state of my research on unos at the time of SuB13. I am very grateful to audiences at TINdag 2008, 'A Bare Workshop II', ICLC 5 and SuB 13 for their interest and very useful comments and suggestions. Special thanks to Corien Bary (for checking the Greek data), Henriette de Swart and Liliane Tasmowski.

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Speaker-Oriented Adverbs of the German -weise Sort

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Abstract
Speaker-oriented adverbs (SpOAs) such as glücklicherweise ‘fortunately’ in German constitute a secondary proposition by predicating over the main proposition and a syntactically often silent argument ‘Beneficient’. Since SpOAs take wide scope, quantifying adverbs, whether negative or positive, may not precede them syntactically as otherwise they would compete for scope-taking over the rest of the sentence and this would cause a clash with the semantics of SpOAs. By uttering a sentence with a SpOA, the speaker performs two illocutionary acts, one assertive and the other expressive about the same propositional content \( p \). The expressive speech act presupposes the assertive one, which is why any use of SpOAs presupposes the truth of \( p \).

1 Introduction

Speaker-oriented adverbs (SpOAs), a term first used in Jackendoff (1972), are usually used to express the speaker’s emotion or evaluation towards the propositional content \( p \) that the speaker asserts by the rest of the sentence or part of the sentence where SpOAs occur. In this paper, I will discuss the lexical semantics/pragmatics of German SpOAs such as glücklicherweise ‘fortunately’ and erfreulicherweise\(^1\) ‘luckily’ in line with their distributional facts. (1) provides examples from google for illustration.

(1)  
\[
\begin{align*}
\text{a. Erstaunlicherweise scheint aus meiner Erkältung keine Grippe zu werden.} & \quad \text{‘Astonishingly, it seems that my cold is not turning into the flu.’} \\
\text{b. 1858 wurde tragischerweise der letzte Kaplöße getötet.} & \quad \text{‘1858, the last Cape Lion was tragically killed.’} \\
\text{c. Verkehrsunfall mit glücklicherweise nur Leichtverletzten.} & \quad \text{‘Road accident with fortunately, only mild injuries resulting in’}
\end{align*}
\]

\(^1\)German SpOAs of this type (ADJ-er-weise) can often be paraphrased as ‘in an ADJ way’. As adverbs, they do not always have English equivalents. For example, erfreulicherweise means ‘in a pleasant way’ and ‘luckily’ is just a rough translation.
d. Die gekürzte Studiofassung wurde unglaublicherweise OHNE(!) die Musik von Ennio Morricone in den USA veröffentlicht.
   ‘The shortened studio version got published in the USA, unbelievably, without the music of Ennio Morricone.’

The paper is organized as follows. I will first provide an overview about the distribution of SpOAs. Section 3 addresses two previous analyses, one that treats SpOAs as positive polarity items (PPIs) (Nilsen 2004, Ernst 2005) and the other that takes the relation between the main proposition \( p \) and SpOAs as conditional (Bonami and Godard 2008): \( p \rightarrow \text{SpOA}(p) \). I will argue that the PPI-labeling of SpOAs is misleading if not entirely wrong and the conditional semantics for SpOAs is not right, either. In Section 4, I will first discuss the semantics of SpOAs in the double-propositional approach following Bellert (1977) and Bach (1999) and then propose that by use of SpOAs the speaker performs two illocutionary acts, one assertive and the other expressive of the same propositional content \( p \). Most crucially, the expressive speech act presupposes the assertive one, and this is why any use of SpOAs presupposes the truth of \( p \). Section 5 concludes the paper.

2 Distribution of SpOAs

To my knowledge, although the study of positive polarity dates back as early as Bolinger (1960), PPIs only started to gain more attention recently. As counterparts of NPIs, PPIs tend not to occur in downward entailing (Ladusaw 1980), henceforth DE, contexts, illustrated below:

\[
\begin{align*}
(2) \quad & \text{a. Mary has } \neg(\text{not}) \text{ got married yet}_{\text{NPI}}. \\
& \text{b. Mary has } (\neg\text{not}) \text{ already}_{\text{PPI}} \text{ got married.}
\end{align*}
\]

Nilsen (1999) claims that SpOAs are PPIs as they are excluded in DE contexts. The corpus search and speaker judgement experiments\(^2\) (Liu and Soehn in press) confirmed their ‘PPI-hood’: 24 subjects all accepted (3a) and all rejected (3b), for example.

\[
\begin{align*}
(3) \quad & \text{a. Die Vorschule hat glücklicherweise einen tollen Spielplatz.} \\
& \text{b. } \neg\text{Die Vorschule hat } \text{nicht glücklicherweise} \text{ einen tollen Spielplatz.} \\
& \text{‘The pre-school has (not) fortunately a great playground.’}
\end{align*}
\]

According to Bellert (1977), besides negatives, SpOAs do not appear in hypotheticals, questions or performative sentences, either. Her observation holds true for the most part, as shown in the following examples. The reason why SpOAs can appear in the antecedent of conditionals or unreal (echo or tag) questions will be explicated later in the paper when we turn to their semantics.

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\(^2\)The experiments used anti-additive (AA) contexts as stimuli as according to Szabolcsi (2004), it is anti-additivity, a subset of DEness, that PPIs are sensitive to.
(4) Conditionals:
   a. indicative: \([Wenn \ldots ?\text{SpOA} \ldots \ldots \ast \text{SpOA} \ldots]\)
      Wenn die Vorschule \(\ast\text{glücklicherweise}\) einen tollen Spielplatz hat, können die Kinder \(\ast\text{erfreulicherweise}\) mehr Sport treiben.
      ‘If the preschool fortunately has a great playground, the kids can luckily do more sports.’
   b. counterfactual: \([Wenn \ldots \ast \text{SpOAs} \ldots \ldots \ast \text{SpOAs} \ldots]\)
      Wenn die Schule \(\ast\text{glücklicherweise}\) einen tollen Spielplatz hätte, könnten die Kinder \(\ast\text{erfreulicherweise}\) mehr Sport treiben.
      ‘If the preschool fortunately had a great playground, the kids could luckily do more sports.’

(5) Questions:
   a. Hat die Vorschule \(\ast\text{glücklicherweise}\) einen tollen Spielplatz?
      ‘Does the preschool fortunately has a great playground?’
   b. Wer ist unglücklicherweise in einen Unfall verwickelt worden?
      ‘Who (again) unfortunately got into an accident?’
   c. Tom ist unglücklicherweise in der Prüfung durchgefallen, gell?
      ‘Tom unfortunately failed in the exam, right?’

(6) Performatives:
   Ich befehle \(\ast\text{glücklicherweise}\) dass Du sofort losfährt.
   ‘I order fortunately that you set off immediately.’

As (3)-(6) show, SpOAs cannot be negated, questioned or hypothesized, which makes them different from manner adverbs and degree adverbs such as ganz ‘entirely’, deutlich ‘clearly’ that can.

Ernst (2005), also labeling SpOAs as PPIs, maintains that they are excluded in non-veridical (Zwarts 1995, Giannakidou 1998) contexts, which also include for instance imperatives or modals besides DE ones.

(7) Imperatives:
   Stirb \(\ast\text{unglücklicherweise}\)!
   ‘Die unfortunately!’

SpOAs, meeting modal adverbs or verbs, must outscope them.

(8) a. Unglücklicherweise ist Peter möglicherweise krank.
    ‘Unfortunately, Peter is possibly sick.’
   b. \(*\text{Möglichwerweise}\) ist Peter ungünstlicherweise krank.
    ‘Possibly, Peter is unfortunately sick.’
   c. Peter könnte ungünstlicherweise krank sein. =
    Es ist unglücklich dass \(\ldots \neq \)
    Es könnte unglücklich sein dass \(\ldots \)
    ‘Unfortunately, Peter could be sick.’ = ‘It is unfortunate that \(\ldots \)’ \(\neq \) ‘It could be unfortunate that \(\ldots \)’
Finally, SpOAs can be embedded by veridical/factive predicates such as wissen ‘know’, bedauern ‘regret’ or reportives such as sagen ‘say’ but not by nonveridical predicates such as neg-raising\(^3\) or volitional ones.

(9) a. Factives:
Maria weiß (nicht) dass Peter unglücklicherweise gestorben ist.
‘Maria does (not) know that Peter unfortunately died.’

b. Assertives:
Maria sagte (nicht) dass Peter unglücklicherweise gestorben war.
‘Maria did (not) say that Peter unfortunately died.’

c. Neg-raising predicates:
Maria glaubt (*nicht) dass Peter unglücklicherweise gestorben ist.
‘Maria does (*not) believe that Peter had unfortunately died.’

d. Volitionals:
Maria hofft (nicht) dass Peter *tragischerweise gestorben ist.
‘Maria does (not) hope that Peter tragically died.

I will come back to these data in the following discussion.

3 Two Misconceptions about SpOAs

This section discusses two previous analyses, namely, the conditional semantics for French evaluatives by Bonami and Godard (2008) and the PPI-labeling of SpOAs by Nilsen (1999) and Ernst (2005). I will first show that although Bonami and Godard’s proposal correctly predicts some of SpOAs’ behavior, it fails to do so for some others. This also leads to my argument for abandoning the PPI-labeling of SpOAs.

3.1 Conditional semantics for SpOAs

According to Bonami and Godard (2008), the oddness of French evaluatives (what we call SpOAs in the present paper) like malheureusement ‘unfortunately’ in the scope of negation (such as *Paul n’est pas malheureusement venu ‘Paul did not unfortunately come’) is due to the clash between the “main assertion” ¬p and the “ancillary commitment” p → SpOA(p). This analysis can elegantly explain the anti-collocational relation between SpOAs and negative contexts. However, it fails to account for the fact that even when preceding adverbs are not negative, such as immer ‘always’, thus a clash should not arise as the ‘main assertion’ is positive, the sentences still remain bad. Compare:

(10) a. Peter ist ungläublicherweise immer/niemals/of/phantmal krank.
‘Peter is unbelievably always/never/often/sometimes sick.’

‘Peter is always/never/often/sometimes unbelievably sick.’

Frank Richter (p.c.) pointed out to me that (9c) is not quite good an example, mainly due to the fact that the neg-raising reading of glauben ‘believe’ is sometimes difficult to distinguish from the non-neg-raising reading. If it is not a neg-raising reading then (9c) would be just as fine as (9a-b), whether negation is present or not.
An explanatory analysis of SpOAs should be able to answer the question either why adverbs such as *immer* ‘always’, *nie* ‘never’, *selt* ‘seldom’ cannot outscope SpOAs, or why SpOAs cannot outscope these adverbs if they take a syntactically higher position, although they can outscope for example, *nichts* ‘nothing’, *niemand* ‘nobody’, *wenig* ‘few’, or modals.

   ‘Happily, nobody was absent from the wedding.’

b. Peter *könnte* ungläublicherweise gut angezogen sein. = Ungläublicherweise könnte Peter gut angezogen sein.
   ‘Unbelievably, Peter could be well-dressed.’

Such adverbs that SpOAs tend only to outscope (both semantically and syntactically) are called quantifying adverbs (Lewis 2002/1975). More examples from English are *invariably*, *universally*, *without exception*, *occasionally*, *usually*, *mostly*, *generally*, *infrequently*, *rarely*. They quantify over cases (which might as well simply be events). For example, *always in A man who owns a donkey always beats it now and then* is a quantifier over the case: [if x is a man, if y is a donkey, and if x owns y, x beats y now and then]. To figure out the semantics of SpOAs, it is helpful to take quantifying adverbs as a test and see how they behave in relation to SpOAs in a sentence.

I have three points to make on why the quantification by these adverbs has to happen before the semantics of SpOAs comes into play. First, SpOAs are not quantifiable themselves as they are not cases: what they express is not for example an event but an (often emotional) evaluation. This blocks SpOAs from being bound alone in the scope of quantifying adverbs. Second, quantifying adverbs cannot quantify over the event or case expressed by the rest of the sentence, if the latter is already modified by a SpOA, because such a case is closed (by evaluation), that is, the truth value of the expressed proposition is already settled and thus allows no further quantification (that should be considered to yield the truth-value). Last, the possibility to have both the content expressed by SpOAs and that by the rest of the sentence be bound by quantifying adverbs is not available due to the very relation between these two contents, which I will discuss more in Section 4. (12) is my formulation of the semantic constraints concerning the co-occurrence of quantifying adverbs and SpOAs (that are treated as predicates as I will show in Section 4): the combinations marked with * are out and the good one is with √.

(12) Semantic constraint of SpOAs:

a. * quantification > predicationSpOA > case
   (i) * (quantification > predicationSpOA) > case
   (ii) * quantification > (predicationSpOA > case)

b. √ predicationSpOA > quantification > case

The semantic constraint in (12b) requires that SpOAs take a syntactically higher position than quantifying adverbs, as they are in a competing relation for scope-taking over the rest of the sentence and syntactically higher ones win. SpOAs have no problem with adverbs in a syntactically higher position if these adverbs cannot take wide scope, such as
yesterday. In (13), we get the reading that it is unfortunate that Peter was sick yesterday. Notably, the SpOA does not only outscope the temporal adverb but also the tense, that is, the entire temporal modification of the sentence.

\[(13) \quad \text{Peter war gestern unglücklicherweise krank.}
\]
‘Peter was yesterday unfortunately sick.’

### 3.2 PPI-labeling of SpOAs

We have seen that although the distributional facts stated in Section 2 seem all to suggest that SpOAs be PPIs, this labeling is misleading. The example of quantifying adverbs show that it is not negative polar quantification that SpOAs are hostile to but adverbial quantification that slips away from the scope of SpOAs, no matter whether it is negative or positive. Quantifying adverbs must follow SpoAs syntactically, because semantically, SpOAs have to take wide scope and a clash would arise if syntax says otherwise.

To render a general remark, the PPIs recorded in the existing literature seem not to be homogeneous. The term of PPIs is to my mind more of a distributional commonness of different things. For instance, SpOAs and PIAs\(^4\) are certainly not of the same kind, although distributionally speaking, both seem to crave for positive polar contexts. This distinguishes PPIs from NPIs in the way that NPIs (at least the set of minimizers) make up a natural class, whereas there is no such corresponding natural class of PPIs.

### 4 The Semantics and Pragmatics of SpOAs

Having discarded the PPI labeling and the conditional semantics for SpOAs, I will now discuss the semantics of SpOAs following the double-propositional view (Bellert 1977, Bach 1999) and the pragmatics of SpOAs in speech act theory. First, I will argue for treating SpOAs as two-place predicates, one argument being the main proposition\(^5\) and the other one a Beneficient that does not necessarily co-incide with the speaker. In speech act theory, by uttering a sentence with SpOAs, the speaker performs two illocutionary acts about the same propositional content \(p\), one assertive and the other expressive/evaluative by use of SpOAs. The assertive one is independent while the expressive presupposes the assertive one, and this is why any use of SpOAs presupposes the truth of \(p\).

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\(^4\) Adverbs of this type are called positive intensifying adverbs (PIAs, Liu and Soehn to appear) such as total ‘totally’, durchaus ‘absolutely’ also tend not to occur in negative contexts, but for the reason that they contribute no propositional content to a sentence but are used as conventional tools to intensify an (mostly positive) utterance and therefore negating, questioning or hypothesizing of them would be vacuous.

\(^5\) ‘Proposition’ has always been a confusing term to me and I guess, probably to many others as well. In the current analysis, I take propositions as something truth-evaluable, though, what I take as linguistic means to express propositions might differ from many existing proposals: to me, besides sentences, the speaker can use certain noun phrases such as ‘the king of France’, prepositional phrases such as ‘with a pair of sunglasses’ to express propositions, and the reason why we usually only interpret an atomic sentence as a single proposition is but a question of theoretic convenience and necessity.
4.1 Semantic Duality

The double-propositional insight for SpOAs is found at least in Jackendoff (1972), Bellert (1977) and Bach (1999). Jackendoff (1972) maintains that modal adverbs such as certainly are predicates over a sentence, while SpOAs such as happily predicate over a sentence and the argument SPEAKER, that is, \( SpOA(SPEAKER, S) \). Thus modal adverbs should be handled differently from SpOAs. Modal adverbs are added to the rest of the sentence to constitute one proposition. SpOAs predicate over the main proposition expressed by the rest of the sentence, and this predication constitutes an extra proposition. Bellert echoes this view (1977: p.342) about SpOAs: “the adverb makes a second proposition by evaluation of the fact, event, or states of affairs denoted by S.” Bach (1999) calls SpOAs assessives and claims that they “contribute to the content of the utterance” (p.359) by a second - evaluative/assessive - proposition. However, paraphrasing modal ADVs and SpOAs such as certainly and happily, we can easily get the same structure it is certain/happy that \( S \). Since both epistemic certainty and emotive evaluation are in the end speaker-oriented, to what extent do they really differ? The solution I suggest here is to treat SpOAs as two-place predicates taking Beneficient (or Recipient, Experiencer) as the second argument, that is, \( SpOA(S, Beneficient) \). By contrast, modal adverbs are one-place predicates such that \( ModalAdv(S) \).

4.1.1 Beneficient and Speaker

Bonami and Godard (2008) already express doubt concerning the notion of the speaker-orientation for French evaluatives: “the agent responsible for the evaluative may be different from the speaker. Accordingly, an adequate analysis must not presuppose that evaluatives are strictly speaker-oriented” (p.15). The assigning of Beneficient instead of SPEAKER as the second argument solves the problem. This means that the emotion or evaluation that the speaker expresses by use of SpOAs towards the main proposition could be attributed to the speaker himself, but also to the addressees, the subject of the sentence, etc. In other words, the Beneficient might co-incide with the speaker, but this does not have to. It can be made explicit linguistically, with for-phrases in English as in (14a), or contextually. In (14b), the fact that Paul screwed up in the final exam is unfortunate for him and maybe for the speaker as well.

\[
\begin{align*}
(14) & \quad \text{a. Unfortunately for most female PhD students, having babies can add unnecessary stress to their academic lives.} \\
& \quad \text{b. Paul unfortunately screwed up in the final exam.}
\end{align*}
\]

Despite the context dependency of Beneficients, a felicitous use of SpOAs presupposes the existence of such a Beneficient. In a war situation where the speaker informs his own party about the serious casualties of the opposite party, the use of unglücklicherweise or tragischerweise will be outrageous. This means that the existence of such Beneficients should be in the semantics of a sentence with SpOAs, therefore, I propose to render this

\[\text{6Of course, we can introduce the argument SPEAKER into both cases, ending up with SpOAs as three-place predicates and modal adverbs as two-place ones, but this move will lead to redundancy, as we then need to assign every sentence a SPEAKER argument.}\]
argument into the logical form of such a sentence: \((\lambda Q. \lambda P. Q(P, \text{Beneficient}))(\text{spoa})\), although it is often syntactically silent.

### 4.1.2 Proposition and Sentence

One can argue whether the contribution by SpOAs is propositional, i.e. whether it has a truth value. However, by introducing the Beneficient as their argument, the meaning contribution of SpOAs is indeed truth-evaluable. If the speaker says that *Sadly for Paul, he screwed up in the final exam*, the meaning of SpOAs is truth-evaluable in terms of whether Paul truly or falsely has sad emotions due to the fact that he screwed up in the final exam. Emotions, despite the perceptive difficulty in comparison, are entities/Dasein, I believe. Therefore, by a sentence with SpOAs the speaker expresses (at least) two propositions. The rule of ‘one sentence, one proposition’, although practical in most cases, is but of theoretic convenience. Bach (1999) and Potts (2005) both challenged this view in their discussions of conventional implicatures including the cases of *but* and SpOAs. I do so as well but also for an extra reason, namely, the main proposition that SpOAs predicate over might be the rest of the sentence or just a fragment of it. SpOAs do not necessarily take the rest of the sentence as their (immediate) affective domain.

\[(15) \quad \text{Peter war unglücklicherweise gestern krank.} '\text{Peter was unfortunately sick yesterday.}'\]

\[\text{a. Peter war unglücklicherweise GESTERN krank.} '\text{Peter was unfortunately yesterday sick.}'\]

\[\text{b. Gestern war unglücklicherweise PETER krank.} '\text{Unfortunately, Peter was yesterday sick.}'\]

(15) shows that SpOAs, despite their syntactical category as sentence adverbs, are subject to the focus effect of the rest of the sentence. Intonation and word order change can be used to clearly indicate their affective domain, which can be the entire sentence such as in (15) or a propositional fragment of it such as capitalized in (15a) and (15b). The latter two sentences can be best paraphrased with cleft constructions, roughly as *it is unfortunate that it is yesterday that Peter was sick* and *it is unfortunate that it is Peter who was sick yesterday*. In a similar way, we can paraphrase the sentences in (1) as (16): only in (1a) does the SpOA take the entire rest of the sentence as its argument.

\[(16) \quad \text{a. It is astonishing that it seems that my cold is not turning into the flu.} \]

\[\text{b. 1858, the last Cape Lion was killed. It is tragic that the last Cape Lion was killed.} \]

\[\text{c. (There was a) road accident. It is fortunate that people were only mildly injured.} \]

\[\text{d. The shortened studio version got published in the USA. It is unbelievable that they published it without the music of Ennio Morricone.} \]

This is to show that SpOAs also provide evidence for the multipropositionality of natural language sentences without SpOAs: for example, in (1c) the prepositional phrase expresses a proposition. Therefore, not only does ‘one sentence’ not necessarily express
only ‘one proposition’, but ‘one proposition’ does not have to be expressed by ‘one sentence’.

4.2 Pragmatic Asymmetry

I have argued above that the meaning contribution by SpOAs can be analysed as propositional, that is, two things (propositions) are said in a sentence with SpOAs. However, these two things are not said equally. In this section, I will show that the truth/falsity of the proposition that the speaker expresses by SpOAs is dependent on that of the main proposition and has correspondingly a secondary status in discourse logic. In other words, there is a pragmatic asymmetry between them. In the following, I will briefly discuss Potts’s (2005) analysis and then propose an alternative analysis in speech act theory.

4.2.1 SpOAs as conventional implicatures

Potts (2005) treats SpOAs as conventional implicatures (CIs), which he considers to be entailments, but different from what he calls “at-issue entailments”. Informally, (17) entails both (17a) and (17b), but the former is the at-issue entailment and the latter the CI.

(17) Luckily, Willie won the pool tournament. (Potts 2005: p.187)
   a. \( p \): Willie won the pool tournament.
   b. \( \lambda p . \text{lucky}(p) \)

Although the term of CI is sometimes confusing as Potts admits himself, with his analysis, we are able to distinguish (17) from (18). In (18a), the at-issue content is \( \lambda p . \text{lucky}(p) \) and in (18b), both \( p \) and \( \lambda p . \text{lucky}(p) \) are at-issue contents due to the conjunction.

(18) a. It is lucky that Willie won the pool tournament.
   b. Willie won the pool tournament and this is lucky.

It is worth noting that SpOAs, or CIs in general, do convey new information, just as the definite NP in The king of France is bald could be new information for people who didn’t know whether France is Republican or Monarchic. In this sense, both CIs and presuppositions differ from “at-issue entailments” essentially in terms of informative prominence.

4.2.2 SpOAs in speech act theory

SpOAs are illocutionary words (Bellert 1972, Bartsch 1976). First consider:

If we adopt illocutionary point as the basic notion on which to classify uses of language, then there are a rather limited number of basic things we do with language: we tell people how things are, we try to get them to do things, we express our feelings and attitudes, and we bring about changes through our utterances. Often, we do more than one of these at once in the same utterance. (Searle 1979: p.155)
In one and the same utterance with SpOAs, the speaker does not only tell people how things are but at the same time also expresses his or someone else’s feelings and attitudes towards the way things are. However, there is a question of (logical) order in doing the two things, as I formulate below:

(19) Pragmatics of SpOA\( (p) \):
The speaker performs two speech acts, one (factually) assertive and the other expressive of the same propositional content \( p \). The assertive speech act is performed independently. However, the expressive speech act presupposes the assertive one, therefore, any use of SpOAs presupposes the truth of \( p \).

With (18a), the speaker only performs one assertive speech act of the propositional content that \textit{It is lucky that Willie won the pool tournament}, while with (18b), the speaker performs two assertive speech acts of two different propositional contents by conjunction. In the case of SpOAs, the expressive content is parasitic on the asserted content, and secondary to the latter, as the expressive speech act cannot be successfully performed if the assertive speech act is not successfully performed, but not vice versa.

By uttering a sentence \( (\lambda Q. \lambda P.Q(P,Beneficient))(s poa) \), the speaker commits himself to both the truth of \( P \) and the (evaluative/emotional) content \( Q \) towards \( P \) for the beneficiary of the described state of affairs by \( P \). \( P \) and \( Q \) can both be negated independently (Bellert 1977), but not at the same time due to their very relation: denying \( P \) makes the denying \( Q \) unnecessary and denying \( Q \) presupposes the agreeing on \( P \). The truth/falsity of \( P \) is independent of that of \( Q \), while \( Q \) becomes an issue only when \( P \) holds true (is asserted). This is illustrated below:

(20) A: Tom is unfortunately dead.
    B: No, he is not dead.
    B’: He is dead, but it is not unfortunate for you!
    B”: He is dead, but it is not unfortunate to me.

4.3 (Non-)Veridicality

In Section 3, I have shown that SpOAs take wide scope and they should precede quantifying adverbs, whether they are negative or positive, because quantifying adverbs also take wide scope over the rest of the sentence and if they syntactically predece SpOAs, this will cause a clash. The pragmatics of an utterance \( SpOA(p) \) as I formulated in (19) says that any content predicated over by SpOAs is asserted by the speaker and therefore does not allow any further quantification. This applies for the negative adverb \textit{nicht} ‘not’ as well: informally speaking, you cannot tell people how things are and express the feelings or evaluations while simultaneously denying the way things are.

SpOAs also tend not to occur in contexts such as conditionals, yes-no questions, performative sentences, imperatives, neg-raising predicates, volitionals, modals, as by these things the speaker does not assert the embedded proposition, i.e. the speaker does not state how he believes the world is, thus it would be odd to use SpOAs, which predicate over a proposition that is asserted. In brief, if we do not know “how things are” in the
first place, it is impossible to “express our feelings and attitudes” towards the way they are.
Concerning modals, it is observed by Regine Eckardt (p.c.) that if we change möglicherweise ‘possibly’ in (8b) into vielleicht ‘maybe’, the sentence turns good. I think the meaning contribution of vielleicht here is similar to that of ich glaube ‘I believe’: in both cases, the speaker expresses his uncertainty about what he asserts, which makes the assertion sound weaker, but it is definitely different from möglicherweise where the content by the rest of the sentence is simply not asserted\(^7\).

(21)  
\begin{align*}
\text{a. Vielleicht ist Peter unglücklicherweise krank.} \\
\quad \text{‘Maybe, Peter is unfortunately sick.’}
\end{align*}

\begin{align*}
\text{b. Ich glaube, Peter ist unglücklicherweise krank.} \\
\quad \text{‘I believe, Peter is unfortunately sick.’}
\end{align*}

The reason why SpOAs are possible in the antecedent of indicative conditionals is, as Ernst (2005) points out, because there “the truth of the proposition is still somehow implicated”, while this possibility is certainly unavailable with counterfactuals. As Daniel Hole (p.c.) pointed out, if we substitute if with given that, the occurrence of SpOAs follows even more naturally. It is to note that the speaker could fairly well use conditionals even when she does believe the truth of the antecedent but thinks that the antecedent is not common-grounded, in a similar fashion as the projection problem of presuppositions in conditionals. For the same reason, SpOAs can occur in echo questions and tag questions, as the expressed content is also maintained as true by the speaker, while they are bad in yes-no questions. Most of the contexts stated above seem to echo Ernst’s (2005) observation that SpOAs may not occur in the scope of nonveridical contexts. Briefly, the concept of nonveridicality captures the state of uncertainty, where the truth value of the sentence is not yet known.

(22)  
\begin{align*}
\text{a. } F \text{ is veridical if } Fp \implies p. \\
\text{b. } F \text{ is nonveridical if } Fp \nimp p.
\end{align*}

The notion of nonveridicality is useful for proposition embedding functions: SpOAs do not occur in nonveridial predicates because they would influence the truth of p and therefore lead to a clash with the meaning of SpOAs, while this problem does not arise with factives as they preserve the truth of the embedded proposition and therefore are harmonious with SpOAs. However, the crucial point is that SpOAs cannot occur in the scope of anything\(^8\), veridical or non-veridical, that is, they semantically outscope everything including temporal/modal modification or quantification (see Section 3.1). The examples below demonstrate different behaviors of the same SpOA with regard to the adverbs yesterday and always, although both are veridical.

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\(^7\)This is the reason why möglicherweise should not receive the same analysis as SpOAs of the -weise sort.

\(^8\)One exception are “pragmatic adverbs” (Bellert 1977) or “utterance modifiers”( Bach 1999) such as frankly, sincerely, honestly, briefly, precisely. However, they take scope over SpOAs not semantically but pragmatically, as with these words, the speaker comments on the act of his utterance rather than the content of it.
(23)  a. Peter war gestern \textit{veridical} ung"licklicherweise krank. ‘Unfortunately, Peter was sick yesterday.’

b. *Peter ist immer \textit{veridical} ung"licklicherweise krank. ‘Peter is always unfortunately sick.’

c. Yesterday, Peter was unfortunately sick. ≠

\[ \text{It was yesterday unfortunate that Peter was sick.} \]

However, SpOAs are themselves veridical, as $SpOA(p)$ entails $p$. Whether we take veridicality as a semantic or pragmatic concept, this is in line with the pragmatics of SpOAs as in (19).

5 Summary

In the foregoing, I have argued that the labeling of SpOAs as PPIs is misleading and a conditional semantics for their meaning is not quite right, either. SpOAs predicate over the main proposition where they occur, which yields a secondary proposition. I take both contents as propositional as both are truth-evaluable. However, there is a pragmatic asymmetry between these two propositions, which I showed in speech act theory: by uttering a sentence with SpOAs, the speaker performs two speech acts, one assertive and one expressive of the same propositional content $p$, but the expressive one presupposes the assertive one (therefore, any use of SpOAs presupposes the truth of $p$), while the assertive one is independent.

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Iterated *de re*: A New Puzzle for the Relational Report Semantics

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Abstract
I present and solve a puzzle involving iterated *de re* reports in a relational attitudes framework. The investigation shows that *de re* reporting is even more non-compositional than hypothesized earlier.

1 Introduction

*De re* belief reports are sentences that ascribe to someone a belief about some external entity or *res*. If the content of the ascribed belief is itself a *de re* belief we have an iterated *de re* report. For instance:

(1) John believes that Mary thinks I’m cool

I’ll show that the doubly embedded *I* in (1) is problematic in a context where John *thinks* there is a *de re* belief between Mary and me, while *in fact* Mary’s belief was about someone else. I reconcile the intuitive truth of (1) in such a scenario with the fact that *I* picks out the current speaker, me.

Outline: after fleshing out the scenario and intuitions in section 2, I introduce the framework of relational attitudes in section 3. In section 4 I examine the problematic predictions of this relational analysis with respect to mistaken iterated *de re*. In section 5 I propose a solution, and in 6 I discuss some implications of that solution.

2 Iterated *de re* and mistaken identity

Consider the following scenario:

(2) John and Mary are friends. Mary says: “That guy is cool”. John thought she was pointing to me. In fact, she’s pointing to Peter.
From Mary’s utterance it follows that she has a *de re* belief, not about me, but about Peter. I would be entitled to report her belief as (3a), but not (3b):

(3)  
   a. Mary thinks Peter is cool  
   b. #Mary thinks I’m cool

John also has a *de re* belief, about Mary. Since he is confused about the object of her belief he would disagree with our judgments in (3). Because he thinks Mary’s belief is about me, we intuitively judge (4b) true:

(4)  
   John believes that Mary thinks I’m cool

The puzzling observation is that we use a first person pronoun in (4) even though neither John’s nor Mary’s belief appears to be *de re* about me. More precisely, I will show that the intuitive, relational paraphrase *John believes of Mary that she believes of me that I am cool* of (4) fails to capture the correct truth conditions.

### 3 Background: the relational analysis of *de re*

A traditional way to cash out the difference between modalities *de re* and *de dicto* is in terms of scope. Take the following attitude ascription:

(5)  
   John hoped the new president would be pro-life

On the *de dicto* reading John merely hopes for a pro-life president. On a *de re* reading on the other hand John hoped of a certain individual, the actual new president, Obama, that he would be pro-life. Crucially, in the *de re* reading, John’s hope is about Obama regardless of whom he believed or hoped would be president; the report would be true if John’s thought were of the form ‘I know he won’t win the election, but I hope that Obama is pro-life’.

The scope analysis represents this truth-conditional difference between *de re* and *de dicto* as a difference between wide and narrow scope of the description with respect to the attitude operator:

(6)  
   a. *de dicto*: $\text{HOPE}_j\text{prolife}(\exists x[\text{president}(x)])$  
   b. *de re*: $\exists x[\text{president}(x)]\lambda y\text{HOPE}_j[\text{prolife}(y)]$

In a standard possible worlds framework (intensional first-order logic, with only extensional variables) this seems to make the right predictions. $\mathcal{N}(6a) = 1$ iff in all of the worlds $w'$ compatible with John’s hopes in $w$, the new president of $w'$ is pro-life in $w'$, which indeed corresponds to the *de dicto* interpretation. $\mathcal{N}(6b) = 1$ iff there is a unique individual that is the president in $w$, and that individual has the property of being pro-life in all worlds $w'$ compatible with John’s hopes.

Unfortunately, the wide scope representation of *de re* beliefs is too weak, as Quine (1956) demonstrated with his famous Orncutt example (now often referred to as the double vision thought experiment):
There is a certain man in a brown hat whom Ralph has glimpsed several times under questionable circumstances on which we need not enter here; suffice it to say that Ralph suspects he is a spy.

It follows that Ralph has a de re belief about this man in the brown hat, which we might report with (7a), which has wide scope representation (7b):

\[(7) \quad a. \quad \text{Ralph believes de re of the man with the brown hat that he is a spy} \]
\[b. \quad tx[\text{man\_brown\_hat}(x)]\lambda y[\text{BEL}_x[\text{spy}(y)]] \]

The story continues:

Also there is a grey-haired man, vaguely known to Ralph as rather a pillar of the community, whom Ralph is not aware of having seen except once at the beach.

We conclude:

\[(8) \quad a. \quad \text{Ralph believes de re of the man at the beach that he is not a spy} \]
\[b. \quad tx[\text{man\_beach}(x)]\lambda y[\text{BEL}_x[\neg \text{spy}(y)]] \]

“Now,” Quine adds, “Ralph does not know it, but the men are one and the same”, viz. the spy B.J. Ortcutt. It follows from this and (7) that Ralph believes de re of Ortcutt that he is a spy and from (8) that he believes de re of Ortcutt that he is not a spy. Given our possible worlds semantics and wide scope scope representations of de re belief we can deduce that Ralph believes de re of Ortcutt that he is both a spy and not a spy. In other words, not only is Ralph confused about Ortcutt’s identity, he is also confused about logic, believing a true contradiction. The absurdity of the latter consequence is commonly regarded as proof of the inadequacy of the wide scope analysis of de re.

A popular solution to this problem is the so-called relational analysis of de re, based on Kaplan’s (1969) ‘vivid names’ (more conveniently captured in Lewis’ (1979) terminology, using acquaintance relations, below). The starting point is that x believes de re of y that it has property P iff there is an actual acquaintance relation between x and y, and x believes that the individual she herself is so acquainted with has P. The actual acquaintance relation connecting the subject and the res is taken into the logical form (henceforth, If) to give the descriptive mode of presentation under which the belief is held. This analysis, summarized in (9), thus reduces a de re belief about y that it’s P to a propositional, descriptive belief, viz. that whoever the subject is R-acquainted with is P.

\[(9) \quad a. \quad x \text{ believes de re of } y \text{ that he is } P \]
\[b. \quad \text{If: } \exists R[R(x, y) \land \text{BEL}_x[P(\exists z[R(x, z)])]] \] [to be refined]

Before showing how the relational analysis solves the Ortcutt paradox, let me introduce two refinements to Kaplan’s original proposal as reconstructed in (9).

First, in (9b) we see that the acquaintance relation (R) and res (y) are represented outside the actual belief operator. This requires a separation of res from ascribed content, introducing an aspect of non-compositionality, or, in more syntactic terms, a ‘res movement’. Note that this separation can be made explicit on the surface by means of
the (not quite natural) reformulation of *believes that . . . as believes of . . . that . . .*. I’ll return to this matter in sections 5 and 6 below. For now, we’ll assume that syntax parses belief complements into structured representations of the form *(res, predicate)*. We’ll use the notation BEL*(. . . .)* for *de re* lf’s, i.e. as an abbreviation of the existentially quantified relational representation.

(10) a. x believes *de re* of y that he is P
b. If: BEL* x ⟨y, P⟩*
c. BEL* x ⟨y, P⟩* =_{def} ∃R[R(x, y) ∧ BEL* x[P(1z[R(x, z)])]]*[to be refined]

Second, the representation of the subject x as a variable inside the belief operator in (9b) (or (10c)) will lead to similar kinds of problems as the wide scope representation of Ortcutt. We will not go into this matter too deeply here, but note that the x there really denotes the attitude holder himself, from his own first person perspective. Rather than just *de re* beliefs of the subject about the subject, a subject’s beliefs about himself are typically *de se*. For a full discussion about *de se* and *de re* belief in the relational framework, I refer the reader to Maier (2006). Suffice it to say that, to avoid problems with *de se*, the ‘believes’ in (10a) is further explicated as a property-self-ascription (SELFASCR), following Lewis (1979). That means that the res-separated lf (10b) can be taken to abbreviate the following property self-ascription:

(11) BEL* x ⟨y, P⟩* =_{def} ∃R[R(x, y) ∧ SELFASCR x λz[P(1z[R(x, z)])]]

In words, there is an acquaintance relation R between subject x and res y, and x self-ascribes the property of being uniquely R-acquainted with someone, who is also P.

By way of an illustration, let’s see how this relational semantics solves the Ortcutt puzzle. From the first part of the Ortcutt story (p.348), and the ‘punch line’, we concluded that Ralph has a *de re* belief about Ortcutt, viz. (12a). We now represent this as (12b), rather than (7b):

(12) a. Ralph believes *de re* of Ortcutt that he is a spy
b. BEL* r ⟨o, λz[spy(z)]⟩*

From the second part we gather:

(13) a. Ralph believes *de re* of Ortcutt that he is not a spy
b. BEL* r ⟨o, λz[¬spy(z)]⟩*

Crucially, we cannot combine these two to conclude that Ralph believes *de re* about Ortcutt that he is and is not a spy:

(14) (12b) ∧ (13b) \(\not\Rightarrow\) BEL* r ⟨o, λz[spy(z) ∧ ¬spy(z)]⟩*

This lemma is easily checked by writing out the definitions of the formulas. What the left hand conjunction says is that there is an acquaintance relation between Ralph and Ortcutt under which Ralph believes himself to be acquainted with a spy, and there is another acquaintance relation under which he believes to be acquainted with a non-spy. These two existential statements are indeed non-paradoxically true in our scenario, The
first acquaintance relation would be seeing the guy in the brown hat, the second would be seeing the guy at the beach. The statement on the right hand side is much stronger, and indeed ascribes to Ralph a contradictory belief: Ralph bears an acquaintance relation to Ortcutt and believes the person he is so acquainted with is both a spy and not a spy.

The relational analysis thus avoids the unwanted inference to a contradictory belief. At the same time it preserves the de re/de dicto distinction, in that the former is characterized by the res being scoped out of the logical belief operator, and by the existence of an acquaintance relation that also serves as the mode of presentation of the res inside the belief.

4 The puzzle: embedded double vision

Given the relational system, the most natural parse and logical form of our iterated report (1) would be:

\[
\text{(15) a. John believes de re of Mary that she believes de re of me that I am cool} \\
\text{b. } \text{BEL}_j \langle m, \lambda x [\text{BEL}_x \langle i, \lambda z [\text{cool}(z)] \rangle] \rangle
\]

Surprisingly, with the relational semantics specified above, (15) does not represent a sensible reading. This can be brought out by expanding the structured beliefs as specified by (11):

\[
\text{(16) } \exists R(R(j, m) \land \text{SELFASCRI}_j \lambda u[} \\
\text{\exists R'[R'(1v[R(u, v)], i) \land \text{SELFASCRI}_v[R'u, v'))]}\lambda u' [} \\
\text{\text{cool}(1v'[R'(u', v')])]]]
\]

The problem with (16) is that there is an indexical, i, occurring inside a semantic belief operator (SELFASCRI). Because indexicals are rigid designators (Kaplan, 1989), i.e. they function like variables bound from outside, they create a singular proposition, similar to that created by the wide scope representation rejected in (6). In other words, we should be able to create an Ortcutt scenario to disqualify it. We achieve this by adding to our scenario (2) a second encounter between John, Mary and me:

\[
\text{(17) John and Mary meet me again. John doesn’t recognize me from the first encounter. Mary to me: “You’re a dork”}
\]

John might report this to me as (18a), which I in turn could report with (18b):

\[
\text{(18) a. John to me: “Mary thinks you’re not cool”} \\
\text{b. John believes that Mary thinks I’m not cool}
\]

We find that in the extended scenario (2)+(17), both (1) and (18b) are true, the latter paraphrased and analyzed below:

\[
\text{(19) a. John believes de re of Mary that she believes de re of me that I am not cool} \\
\text{b. } \text{BEL}_j \langle m, \lambda x [\text{BEL}_x \langle i, \lambda z [-\text{cool}(z)] \rangle] \rangle
\]
Combining the logical forms in (15b) and (19b) should yield an Ortcutt-like contradiction on account of the $i$, which is replaced by a description in the innermost self-ascription, but which nonetheless creates a so-called singular proposition in the outermost one.

Because of the double embedding, however, we do not immediately get a contradiction. John might well think that Mary knows me under two distinct guises and thus has two distinct beliefs that he knows are $de$ $re$ about me. To bring out the inadequacy of (15) and (19) we have to control for this by adding to our story that John thinks Mary met me only once, which, with the same kind of representation as in (15) and (19) looks like this:

(20) a. John believes $de$ $re$ of Mary that she met me only once
   b. $BEL_j \langle m, \lambda x[\exists!R(R(x, m))] \rangle$

Note that this is assumption entirely compatible with the story thus far. Because John doesn’t recognize me on the second encounter, the unique acquaintance he believes to exist between me and Mary is the one underlying the first scene (which, moreover, is in fact an acquaintance relation between Mary and Peter).

As expected, the extended scenario has as an unwanted consequence that John believes that Mary believes a contradiction:

(21) $(15b) \land (19b) \land (20b) \models BEL_j \langle m, \lambda x[BEIL_x\langle i, \lambda z[cool(z) \land \neg cool(z)]\rangle]\rangle$

As Quine showed with his Ortcutt example, one cannot believe two contradictory things about a single actual individual, me ($i$), without taking the different ‘guises’, given by acquaintance relations, of that individual into account.

5 Solution: iterated res movement

Having pinpointed the problem thus, a solution within the relational framework presents itself. What we must do is ‘move’ the doubly embedded $res_i$, one step further, leaving behind a descriptive guise in John’s belief as well as in Mary’s. In (22b-c) I use arrows to depict the $res$ movements that have taken place to derive this new logical form for (1), repeated as (22a):

(22) a. John believes that Mary thinks I’m cool
   b. John believes of Mary and of me that _ believes of _ that _ is cool
   c. $BEL_j\langle m, i, \lambda x\lambda y[BEIL_x\langle y, \lambda z[cool(z)]\rangle]\rangle$

An attempt at an explicit semi-natural language paraphrase: John believes of Mary and of me that the former believes of the latter that he is cool. As is clear from (22b-c), the indexical first person pronoun is moved outside both belief embeddings, so the relational interpretation should be Ortcutt-proof.
To make sure, let’s write out the full definition of the relational beliefs from (11). This requires first a trivial extension to cover beliefs about multiple res:

(23) If $t_1 \ldots t_n$ are terms, and $P$ is an $n$-place predicate:
$$\text{BEL}_x(t_1, \ldots, t_n, P) = \text{def} \exists R_1 \ldots R_n [R_1(x, t_1) \land \ldots \land R_n(x, t_n) \land \text{SELFASC}_{r}^{x} \lambda u [P(1z_1[R_1(u, z_1)], \ldots, 1z_n[R_n(u, z_n)])]]$$

In words: believing de re about a number of res that they’re $P$, means that you’re acquainted with all of them and believe that the representational guises of the res under their respective acquaintance relations, stand in the relation $P$ to each other.

With (23), the fully specified, double movement relational If of (22) looks like this:

(24) $\exists R_1, R_2 [R_1(j, m) \land R_2(j, i) \land \text{SELFASC}_{j} \lambda u [\exists R_3 [R_3(1v[R_1(u, v)], 1w[R_2(u, w)]) \land \text{SELFASC}_{1v}^{1v}[R_1(u, v)] \lambda u'] \land \text{cool}(1v[R_3(u, v')])]]$]

To see why (24) does not suffer from the Ortcutt problems of (16), note that in (24) John no longer has to believe his representation of Mary ($1v[R_1(u, v)]$) to be acquainted with the actual me ($i$), as was the case in (16), but rather with his representation of the actual me under $R_2$ ($1w[R_2(u, w)]$). John’s mistaking me and Peter in the first scene, (2), exploits precisely this distinction between whom one is acquainted with and whom one believes to be acquainted with.

No singular propositions are ascribed in (24), every res is properly moved outside, leaving behind a descriptive, acquaintance-based guise. Consequently, no paradox arises if we continue the scenario as in (17) and (20), which verify the following formulas, respectively:

(25) a. $\text{BEL}_{j}(m, i, \lambda x \lambda y [\text{BEL}_{x}(y, \lambda z [\text{cool}(z)])])$

(25b) $\text{BEL}_{j}(m, i, \lambda x \lambda y [\exists !R[R(x, y)]])$

To see that (22), (25a), and (25b) are indeed jointly verified by our story as a whole, without leading to contradictory beliefs, I will show what acquaintance relations play a role in the various de re beliefs.

First, consider (24), the detailed representation of (22), which shows the three existentially quantified acquaintance relations that play a role. For $R_1$ we can take John’s actual relation to Mary in the first scene, i.e. their being friends. For $R_2$ we must take John’s acquaintance with me, but the scenario doesn’t explicitly specify any such acquaintance. It does say that John “thinks Mary is pointing to me”, which presupposes that John does in fact know me. This way by which John is acquainted with me is our $R_2$. Now, $R_3$ is supposed to hold in John’s mind between his representation of Mary under $R_1$ (my friend) and his representation of me under $R_2$ (that guy Emar). We can take $R_3$ to be the salient seeing and pointing relation witnessed by John according to the story. The content of the belief he ascribes to Mary is then that she believes the person she’s pointing at is a hero, which is in line with the story. Note that we can safely assume that
As for (25a), we can take the same representation of Mary, $R_1$, but the acquaintance between me and John is different. The relevant relation here is the perceptual one that goes with the new pointing. John is acquainted with me as \textit{that guy over there that Mary is pointing at}. The third acquaintance relation, between “my friend Mary” and “the person I see Mary pointing at”, is, again, that very pointing/seeing relation. The content of the belief ascribed to Mary is that the person she is pointing at is not cool. This, too, fits the story precisely. And since the two beliefs John ascribes to Mary on the basis of our two encounters are really about different representations (of a single me) there is no contradiction.

I conclude from this and the previous section that the interpretation of iterated \textit{de re} belief ascriptions of depth $n$, strictly require chains of $n$-res movements, as demonstrated in (22) for $n = 2$. In the next section I’ll look at the consequences of this discovery.

6 Discussion: acquaintance and compositionality

To conclude this paper, let me highlight a number of observations, mostly repeating some remarks already made in passing above.

In discussing (24), the proposed If of (1), we noted an interesting novel prediction of the proposed method of iterated res movement, not shared by the straightforward but ultimately unsatisfactory If discussed in section 4: (1) can only be true if John is vividly acquainted with me. As I pointed out, this is indeed implicitly assumed in the description of the first scenario: in order for John to think Mary is pointing to me, he must have some prior acquaintance with me. What would it mean to mistake someone for someone you have never been in contact with?

A second consequence of the proposed interpretation procedure, is that we now predict (26a), with If (26b), to be true in the the first scene, (2), as well:

$$(26) \begin{array}{l}
\text{a. John believes that Mary thinks Peter is cool} \\
\text{b. } \text{BEL}_j \langle m, p, \lambda x \lambda y[\text{BEL}_x(y, \lambda z[\text{cool}(z)]\rangle] \rangle
\end{array}$$

Let’s see why (26) is true. The crucial acquaintance relation hidden in (26b), is the one between John and Peter. If we take that one to be the perceptual link from the story, it follows that John thinks Mary has a belief about the person they are currently seeing, viz. that he’s cool.

At first sight, the truth of (26) is counterintuitive. But note that (26a) is ultimately \textit{my} report of what happened. If I know Mary was pointing to Peter, and that John’s report was in error, I might well reason that his report was not really \textit{de re} about me but about Peter. In that case, I am certainly not expressing a falsehood if I say (26a), though without explicit further context it is a indeed misleading. To bring out the intended interpretation of (26) I could, for instance, preface it with something like, “John believes Mary thinks the guy she’s pointing at is cool. Though he thinks she’s pointing at me, she is really pointing at Peter. Therefore, actually, [(26) ]”
A final observation concerns the non-compositionality of our solution. von Stechow and Zimmermann (2005) criticize the relational account for requiring what they termed res movement, the syntactic analogue of the essentially non-compositional separation between res and ascribed predicate that is inherent in any form of the relational approach. Note that the current proposal requires an extra res movement for any extra de re embedding. In this sense, the current paper shows that the relational analysis of de re is even more non-compositional than previously thought. This may be taken as evidence in favor of the main rival of the relational approach, i.e. the approach with characterial (two-dimensional) modes of presentation, following Kaplan’s (1989) “Adding ‘Says’”. In fact, the belief semantics based on Kaplan’s analysis of indirect speech is truly compositional—no movements required—and covers de dicto, de re and de se uniformly. However, as von Stechow and Zimmermann show, this approach fails to predict adequate truth conditions for almost every belief ascription. For detailed proof of the inadequacy of a Kaplanian belief semantics, I refer to the proofs in their paper.

Given that Kaplan’s compositional analysis is inadequate for beliefs, and that there’s no real alternative to characters and acquaintance relations, I submit that the non-compositionality of de re is real, and even worse than hypothesized earlier. It remains to be seen though if we can’t integrate the as yet purely syntactic movement into a more semantic or pragmatic mechanism.

References


Maier’s (2006) version of the relational framework makes de re even more non-compositional, in a sense, because it holds that acquaintance relations are to be resolved in the context. On the other hand, the DRT framework employed there allows for different notions of compositionality: contextual resolution plays no role at the first stage of interpretation, the construction of a preliminary DRS, so compositionality at that level is no different from compositionality in the static relational account discussed here.
Constructing Concessive Conditionals: 
In Case of Japanese

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Abstract
This paper presents a compositional analysis of concessive conditionals in Japanese, which consists of a gerundive clause and the particle mo. Unlike the English even if sentences, there is no morpheme like if that apparently signals conditionality. On its surface, it looks as if the existence of mo serves as a combination of ‘even’ and ‘if’. I propose that mo can have a quantificational force over possible worlds. By interacting with the meaning of gerundive clause, it derives the conditionality ‘if’ and the unlikeness ‘even’ meaning. In addition to a general understanding of concessive conditionals in a cross-linguistic view, this study also leads to further questions about mo which has a wide range of properties from additivity to quantification.

1 Introduction

This paper is concerned with the Japanese concessive conditionals in contrast with the even if sentences in English. Consider a sample situation like (1) and the following concessive conditional sentence (2).

(1) SITUATION: Mary has been hospitalized for a long time. Normally, despite her difficult physical condition, she looks very happy when her boyfriend John comes to see her. Exceptionally, though, this is not the case when she needs to get an injection. She hates it so much that . . .

(2) John-ga kite-mo Mary-wa fukigen-da
    John-NOM come.GER-mo Mary-TOP grumpy-is.NONPAST
    ‘Even if John came, Mary would be in a bad mood.’

1Following abbreviations are used in this paper: TOP=Topic Marker, ACC=Accusative Marker, NOM=Nominative Marker, DAT=Dative Marker, CONT=Contrastive Marker, GER=Gerundive Form, COND=Conditional Form

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As the English translation shows, the sentence (2) not only expresses conditionality (under which condition Mary is in a bad mood), but also how unlikely it is, given the normal situation. Concessive conditionals in Japanese consist of an antecedent clause that contains a verb in the ‘gerundive’ form and the particle *mo.*

An interesting puzzle arises when we compare (2) with (3), which is identical to (2) except for the absence of *mo.*

(3) John-ga kite Mary-wa fukigen-da
   John-NOM come.GER Mary-TOP grumpy-is.NONPAST
   ‘John came, and Mary is/will be in a bad mood.’
   **NOT:** ‘If John came, Mary would/will be in a bad mood.’

Without *mo,* not only does it lose the ‘even’ meaning, but it loses the ‘even if’ meaning altogether. The minimal pair (2)-(3) shows that the existence of *mo* on the gerundive clause expresses the *if*-meaning (conditionality) and the ‘even’ meaning (unlikeliness, unexpectedness) at once.\(^3\) The main purpose of this paper is to derive the concessive conditional meaning compositionally and show how *mo* on the gerundive clause turns ‘p and q’ (3) into ‘even if p, q’ (2). As it will be shown in section 4, this leads us to further questions of understanding the property of this particle *mo* and the gerundive construction in Japanese. Before I present my solution to the puzzle, let us review the two basic notions crucial for the meaning and structure of concessive conditionals, i.e. conditionality (section 2.1) and unlikeliness (section 2.2).

## 2 Backgrounds

### 2.1 Conditionality

Being accompanied by the conditional meaning, sentence (2) does not show a prototypical conditional construction. Typically, the antecedent clause of conditional sentences has some sort of conditional morpheme such as the ‘conditional’ (*r*)eba clause, the ‘perfective’ tara clause, and the ‘assertive’ nara(*ba*) clause (Kuno, 1973).

(4) a. (Moshi) John-ga kureba Mary-wa kigen-ga warui
   (If) John-NOM come.COND Mary-TOP mood-NOM bad.NONPAST
   ‘If John comes, Mary will be in a bad mood.’

b. (Moshi) John-ga kitara Mary-wa kigen-ga warui
   (If) John-NOM come.PAST.if Mary-TOP mood-NOM bad.NONPAST
   ‘If John has come, Mary will be in a bad mood.’

---

\(^2\)For this particular form of verbs (and adjectives), also typically named ‘TE-form’ in Japanese textbooks, I call it ‘gerundive form’, following Kuno (1973) and Hasegawa (1996, p.765).

\(^3\)One of the reviewers has asked if the conditionality can be removed from the unlikeliness meaning. That is, if the sentence (2) could mean ‘Even John came, and Mary is unhappy.’ This is not available, which suggests that the conditionality is not optional in this structure.
c. (Moshi) John-ga kuru-nara Mary-wa kigen-ga
   (If) 
   kuru-NOM come.NONPAST-if Mary-TOP mood-NOM 
   warui
   bad.NONPAST
   ‘If it is the case that John comes, Mary would be in a bad mood.’

Note that all types of conditional clauses optionally take an adverb moshi. Although the antecedent clause in (2) does not have any of these overt conditional morphemes, it can take the adverb ‘moshi’. This is not possible without mo.

(5) a. (Moshi) John-ga kite-mo Mary-wa kigen-ga warui
   (If) 
   kite-GER-mo Mary-TOP mood-NOM bad.NONPAST
   ‘Even if John came, Mary would be in a bad mood.’

       *Moshi John-ga kite Mary-wa kigen-ga warui
       If John-TOP come.GER Mary-TOP mood-NOM bad.NONPAST
   Intended: ‘If John came, Mary would be in a bad mood.’

Thus, adding mo to the gerundive clause makes the clause conditional.

It is not uncommon to find conditionality without an overt conditional morpheme. In English, for example, the conditional meaning arises without a canonical conditional morpheme like if.

(6) a. Pay within a week and you’ll get a 10 percent discount.
       (If you pay within a week you get the discount.)

b. We need to pay the bill today or we won’t get the discount.
       (If we don’t pay the bill today we won’t get the discount.)

       (Huddleston and Pullum, 2005)

(7) a. Standing on a chair, John can touch the ceiling.
       (If he stands on a chair, John can touch the ceiling.)

b. In first gear, the truck might reach the top of that hill.
       (If it were in first gear, the truck might reach the top of that hill.)

       (Stump, 1985)

Stump (1985) adopts possible worlds semantics, namely Kratzer’s theory of conditional modality, to account for the conditional meaning in various free adjunct constructions (Kratzer, 1981, 1986). The conditionality is represented by quantification over worlds. For example, a sentence with must (8) can be interpreted in different ways, i.e. epistemic (8-a) or deontic (8-b).

(8) John must be in his office now.

   a. (In view of what is known,) John must be in his office now.

   b. (In view of the school regulation,) John must be in his office now.

A context dependent modal like must is interpreted with respect to what kind of world we are talking about. The meanings of must in (8-a) and (8-b) are different in that respect.
(9) a. (8-a) is true in \( w \) iff,
\[
\forall w' \left[ \text{what is true in } w' \text{ is the closest to what we know in } w \implies \text{in-office}(J)(w') \right]
\]
(John is in his office in all those possible worlds which are closest to what is known in \( w \).)

b. (8-b) is true in \( w \) iff,
\[
\forall w' \left[ \text{what is true in } w' \text{ is the closest to what the rule says in } w \implies \text{in-office}(J)(w') \right]
\]
(John is in his office in all those possible worlds which are closest to what the rule requires in \( w \).)

In conditional sentences, the domain of possible worlds is now specified by the antecedent clause. Thus, in the following examples, the if- clauses serve as a domain of universal quantification of worlds for the consequent clause to be true.

(10) a. If you saw his car parked on campus, John must be in his office now is true in \( w \) iff,
\[
\forall w' \left[ \text{what is true in } w' \text{ is the closest to what we know in } w \text{ and John's car was parked on campus in } w' \implies \text{in-office}(J)(w') \right]
\]

b. If it is his office hour now, John must be in his office now is true in \( w \) iff,
\[
\forall w' \left[ \text{what is true in } w' \text{ is the closest to what the rule requires in } w \text{ and it is his office hour in } w' \implies \text{in-office}(J)(w') \right]
\]

Following Stump (1985), we will extend this modal analysis to the conditional sentences without an overt conditional marking. Let us assume that the modal would essentially works the same as must as suggested by Stump.\(^4\)

### 2.2 Unlikeliness and ‘Even’

*Even* in English is generally considered as a focus sensitive morpheme (Karttunen and Peters, 1979; Giannakidou, 2007). According to Karttunen and Peters (1979), the meaning of (11), which has a focus on *Bill*, indicated by capitals, is a combination of (a-c) in (12).

(11) *Even* BILL likes Mary.

(12) a. Bill likes Mary. \hspace{1cm} \text{(Assertion)}

b. Other people besides Bill like Mary. \hspace{1cm} \text{(Existential Presupposition)}

c. Of the people under consideration, Bill is the least likely to like Mary. \hspace{1cm} \text{(Scalar Presupposition)}

The following shows one way to formalize (12) (cf. Giannakidou (2007); Nakanishi (2006); Yoshimura (2007)).

\(^4\)“*Would* and *might*, according to Kratzer, are interpreted just like *must* and *can*, respectively. […] *Would* and *might*, furthermore, can be used with if- clauses whose propositions are incompatible with ‘common knowledge’, or the presuppositions of language users […]” (Stump, 1985, 49-50)
(13) Where $x$ is a variable for individuals, $\text{like-mary}(\text{Bill})$ corresponds to the proposition ‘Bill likes Mary’, $C$ a set of individuals that is salient in the context,

a. $\text{like-mary}(\text{Bill}) = 1$

b. $\exists x \in C[\neg \text{Bill} \land \text{like-mary}(x)]$ (A set of alternatives)

c. $\forall x \in C[\neg \text{Bill} \to \text{like-mary}(\text{Bill}) <_{\text{likely}} \text{like-mary}(x)]$ (Scalar Presupposition)

Here, the set of alternatives is a set of entities, i.e. the people other than Bill.

On the other hand, Guerzoni and Lim (2007) formalize (12) in another way.

(14) Where $p$ is a variable for propositions, $w$ a possible world, $C$ a set of propositions that has derived from focus assignment, and $\text{Bill-likes-Mary}(w)$ corresponds to ‘Bill likes Mary in $w$’,

a. $\text{Bill-likes-Mary}(w) = 1$

b. $\exists p \in C[p \neq \text{Bill-likes-Mary}(w) \land p(w) = 1]$

c. $\forall p \in C[p \neq \text{Bill-likes-Mary} \to \text{Bill-likes-Mary} <_{\text{likely}} p]$

Instead of the set of entities, (14) has a set of propositions. Among the set of propositions, ‘Bill likes Mary’ is the least likely case. By adopting alternative semantics for focus (Rooth, 1992, 1997), the set of propositions is generated basically by substituting the focused phrase with other relevant phrases. In the case of (11), the set $C$ looks like (15).

(15) $C = \{\text{Bill likes Mary, John likes Mary, George likes Mary, ...}\}$

According to them, a concessive conditional in (16), where $\text{John}$ is focused, is analyzed in the following way.

(16) *Even if JOHN came, Mary would be in a bad mood.*

a. $\text{If John came Mary is in a bad mood}(w) = 1$

b. $\exists p \in C[p \neq \text{If John came Mary is in a bad mood}(w) \land p(w) = 1]$

c. $\forall p \in C[p \neq \text{If John came Mary is in a bad mood} \to \text{If John came Mary is in a bad mood} <_{\text{likely}} p]$

d. $C = \{\text{If Bill came Mary is in a bad mood, If Sue came Mary is in a bad mood, If Alex came Mary is in a bad mood, ...}\}$

This shows that (16) means the same as ‘if John came Mary is in a bad mood’ with a scalar unlikeliness meaning such that ‘if John came Mary is in a bad mood’ is the least likely proposition among others in $C$.

Guerzoni and Lim (2007) also analyze a case in which an *even-if* sentence does not have an apparent focuse phrase like $\text{JOHN}$ in the antecedent clause. They posit a phonologically null morpheme AFF, referring to Höhle’s (1992) VERUM focus.

(18) *Even if John AFF came, Mary would be in a bad mood.*

According to them, the null AFF can be focused, in which case the alternative set looks like (19).
My analysis is not concerned with the AFF morpheme. However, I share the idea that the unlikeliness meaning involves an alternative set of propositions. In the next section, I present my analysis of the Japanese concessive conditionals based on the two basic concepts reviewed in this section.

3 A Solution Proposal

3.1 The Gerundive Construction

Before presenting an analysis of *mo*, let us first turn to the gerundive construction so that we can add *mo* later and derive the meaning compositionally.

(20) John-ga *kite* Mary-wa *gokigen-da*
    John-NOM come.GER Mary-TO P happy-is. NONPAST
    ‘John came, and Mary is happy.’

The gerundive construction (20) looks like a coordination, or a conjunction of two propositions. It is true that John came and that Mary is happy. I will further add a notion of normality that derives likeliness. For the speaker who says (20), it is normal for the two events, John’s coming and Mary’s being in a good mood, to co-occur in a particular world.\(^5\) I implement this normality using quantification over possible world \(w'\).

\[
[\text{GER}]_w = \lambda p_{(s,t)} \lambda q_{(s,t)} [\forall w'[[\text{NORM}_w(w') \land john\text{-}came(w')] \rightarrow q(w')]]
\]

Where \(\text{NORM}_w(w')\) stands for ‘what is true in \(w'\) is the closest to what we think is normal in \(w\)’.

In case of (20), by substituting \(p\) with ‘John came in \(w\)’ and \(q\) with ‘Mary is happy in \(w\)’, we get the meaning (22).

(22) \([20]_w = \left[ john\text{-}came(w') \land happy\text{-}mary(w') \land \forall w'[[\text{NORM}_w(w') \land john\text{-}came(w')] \rightarrow happy\text{-}mary(w')] \right]

Thus, (20) means that John came and Mary is happy. Furthermore, there is a sense of normality, i.e. in all normal worlds, if John comes Mary is happy. With respect to the normal worlds in which Mary is happy if John came, the coordinated statement ‘John came and Mary is happy’ is nothing surprising or unlikely.\(^6\)

---

\(^5\)I set aside an issue of tense. The gerundive form lacks past/non-past morphology, therefore its interpretation of tense is not clear. I assume a free variable for the tense of gerundive clause to be given temporal information in some way.

\(^6\)If the two events, John’s coming and Mary’s being in a good mood, are not expected to be normal things to co-occur, then the conjunction ‘but’ may be more suitable.

John-ga kita-kedo Mary-wa gokigen-da.
John-NOM come.PAST-but Mary-top happy-is.NONPAST
‘John came, but Mary is happy.’
3.2 Quantification by \textit{MO}

What has been observed in section 1 is that the particle \textit{mo}, being attached to the gerundive clause, introduces conditionality and unlikeliness. I adopt the modal analysis for conditionals (section 2.1), and propose the denotation of \textit{mo} as in (23). It departs from the analyses of \textit{even} in section 2.2, in that it does not have the scalar likeliness representation in a form of $\langle \text{likely} \rangle$. It nevertheless derives the unlikeliness meaning of concessive conditionals, as I will explain below.

\[(23) \quad [\textit{mo}]^w = \lambda f_{(st,st)} \lambda q_{(st,t)} . \exists q'[q' \neq q \land f(q')(w)] \land \forall w'[f(q')(w) \rightarrow q(w')]\]

\[(24) \quad \begin{array}{c}
\langle st,st \rangle \quad \text{John-NOM come-GER} \\
\langle st,st \rangle \quad \text{mo} \\
\langle s,t \rangle \quad \text{Mary-TOP grumpy-is.NONPAST}
\end{array}\]

First, \textit{mo} takes the first argument, a set of propositions $f_{(st,st)}$ (the gerundive clause [John-NOM come.GER]).

\[(25) \quad [\textit{mo}]^w([\textit{John-NOM come.GER}]^w) = \lambda q . \left[ \exists q'[q' \neq q \land \text{John-came}(q')(w)] \land \forall w'[\text{John-came}(q')(w) \rightarrow q(w')] \right]\]

Then, it takes the second argument, a proposition $q_{(s,t)}$ (the consequent clause [Mary-TOP grumpy-is.NONPAST]), which yields the concessive conditional (2).

\[(26) \quad [[(2)]^w = [[\textit{John-NOM come.GER-mo}]^w([\textit{Mary-TOP grumpy-is}]^w)]^w
\quad = \left[ \exists q'[q' \neq \text{grumpy-Mary} \land \text{John-came}(q')(w)] \land \forall w'[	ext{John-came}(q')(w) \rightarrow \text{grumpy-Mary}(w')] \right] \quad \cdots (i)\]

\[(27) \quad (2) \text{ is true in } w \text{ iff}
\quad \begin{array}{l}
a. \text{ There is an alternative proposition } q' \text{ that is not } \text{‘Mary is in a bad mood’}, \text{ for instance } \text{‘Mary is happy’}, \text{ such that} \\
\quad [\text{John-NOM come.GER}]^w(q'), \quad \cdots (i) \\
b. \text{For all worlds } w' \text{ such that } [\text{John-NOM come.GER}]^w(q'), \text{ Mary is in a bad mood in } w'. \quad \cdots (ii)
\end{array}\]

It may not be clear where the unlikeliness meaning is in (27). Unlike previous proposals for \textit{even}, my denotation of \textit{mo} does not have a scalar likeliness meaning in a form of $\langle \text{likely} \rangle$. For the present analysis, the crucial part which is responsible for the (un)likeliness meaning is the gerundive clause. Let me illustrate (27) in more detail referring to the proposed denotation of the gerundive morpheme.
(28) From (21),

\[
\llbracket \text{John-NOM come.GER} \rrbracket^w(q') = \left[ \forall w' \left[ \left[ \text{NORM}_w(w') \land \text{john-came}(w') \right] \rightarrow q'(w') \right] \right]
\]

Suppose \( q' \) a proposition such as ‘Mary is happy’.\(^7\) (28) is a gerundive sentence, meaning ‘John came and Mary is happy’. It also presupposes that ‘normally if John came Mary is happy’. In other word, the presupposition ‘normally if John came Mary is happy’ is what makes the conjunction ‘John came and Mary is happy’ likely and usual. (i) states an existence of such \( q' \). (ii) involves a quantification over possible worlds. The domain of restriction is the presupposed normal worlds \( w' \) that has been introduced by the gerundive clause (28).

(29) The meaning of (ii):

\[
\forall w' \llbracket \text{John-NOM come.GER} \rrbracket^w(q') \rightarrow \llbracket \text{Mary-TOP grumpy-is} \rrbracket^w
\]

\[
= \forall w' \left[ \left[ \text{john-came}(w) \land q'(w) \land \forall w' \left[ \left[ \text{NORM}_w(w') \land \text{john-came}(w') \right] \rightarrow q'(w') \right] \right] \rightarrow \text{grumpy-Mary}(w') \right]
\]

This shows that in all worlds \( w' \), Mary is in a bad mood. The domain of \( w' \) is the normal world that originates from the gerundive clause, in which ‘Mary is happy if John came’ is considered to be normal. ‘Mary is in a bad mood in \( w' \)’ is out of the normal situation that exist at this point. Therefore, it is unexpected with respect to the normality introduced by the gerundive construction.

In this section, I have shown how the combination of the gerundive construction and \textit{mo} derives the concessive conditional meaning, conditionality and unlikeliness, in a compositional way. The key point is that it is not the particle \textit{mo} itself, but is the gerundive clause that can presuppose the normality. In the remaining part of the paper, I consider some other peculiarities of the gerundive clause and \textit{mo} and investigate further issues that still need to be accounted for.

4 Further Issues

4.1 On \textit{MO}

One of the things I attempted is not to impose the unlikeliness meaning directly onto the denotation of \textit{mo}. The intuition behind this is that \textit{mo}, just by itself, probably does not inherently have such (un)likeliness meaning. The following examples show that \textit{mo} appears to function as the additive particle ‘too’ or ‘also’ without the ‘even’ meaning.

(30) a. John-\textit{mo} san-ji-ni keeki-o tabeta.
John-\textit{mo} three-o’clock-at cake-\textit{ACC} eat.PAST
‘John ate cake at 3 too.’ (Someone besides John ate cake at 3.)

b. John-\textit{ga} san-ji-ni keeki-\textit{mo} tabeta.
John-NOM three-o’clock-at cake-\textit{mo} eat.PAST
‘John ate cake too at 3.’ (John ate something besides cake at 3.)

\(^7\)I am simplifying the possible worlds: Mary is either in a bad mood (grumpy) or happy.
   ‘John ate cake at 3 too.’ (John ate cake at some other time.)

d. Mary-wa [John-ga keeki-o tabeta]-to-mo itteita.
   ‘Mary also said John ate cake.’ (Mary said something else.)

One might assume that mo in (30) and mo in concessive conditionals are lexically ambiguous: one for the additive particle that is attached to a noun phrase, and the other for ‘even’ when it occurs with a gerundive clause.8

There are other cases, where mo occurs with some specific amount expressions such as ‘three pieces’ and ‘18 hours’, which results in neither the additive meaning nor the ‘even’ meaning.

   ‘John ate three pieces of cake.’ (Three pieces of cake is a lot!)

b. John-ga juuhachi-jikan-mo neta.
   ‘John slept for 18 hours.’ (18 hours of sleep is a lot!)

The sentences in (31) express the speaker’s surprise with respect to the amount.9 If this surprise meaning should also originate from the notion of normality, my attempt to excluding the likeliness meaning from the denotation of mo may not be plausible. However, the analysis of (31) requires an investigation of how the numeral/amount expressions work, which goes beyond the topic of this paper.

Another major issue of mo, besides the additive meaning and the ‘even’ meaning, is its property of quantification over variables introduces by wh-phrases (Nishigauchi, 1991; Kratzer and Shimoyama, 2002; Shimoyama, 2006).

(32) Dono-gakusee-mo odotta.
   Which-student-mo danced
   ‘Every student danced.’

According to their view, the wh-phrase in (32) provides a set of entities that are students, which will be quantified by mo.

(33) a. For $[[\alpha]]^g \subset D_e$, $[[\alpha \ mo]]^g = \{\lambda \forall x [x \in [[\alpha]]^g \rightarrow P(x) = 1]\}$

b. $\{\forall x [x \in \{y: \text{student}(y)\} \rightarrow \text{dance}(x)]\}$

The denotation of mo in (23) proposed in this paper cannot directly account for this fact. The denotation (23) so far only works for the case where mo takes a function from proposition to proposition, a set of propositions, and not an entity or a set of entities.

---

8However, as noted by Giannakidou (2007) and also pointed out by Henk Zeevat (p.c.), the cross-linguistic evidence seems to suggest that it is not an accident for the additive particle and the ‘even’-like morpheme to be expressed by the same morpheme.

9It cannot mean ‘surprisingly less’ for unknown reasons.
Again, at this point, we can posit a lexical ambiguity view to this fact too, leaving a comprehensive understanding of the multi-functionality of *mo* for future research.

### 4.2 On the Gerundive Form

At the beginning of the paper, we observed that the meaning of a simple gerundive construction in Japanese looks like a coordination of two clauses.

\[
\text{(3) John-ga kite Mary-wa fukigen-da} \\
\text{John-NOM come.GER Mary-TOP grumpy-is.NONPAST}
\]

‘John came, and Mary is/will be in a bad mood.’

Unlike the logical conjunction, the proposed denotation of the gerundive clause has a part where the two clauses are in an antecedent-consequent relationship (\(\forall w'[\text{NORM}_w(w') \wedge \text{john-came}(w') \to q(w')])\) in addition to the conjunctive meaning (\(p(w) \wedge q(w))\).

\[
\text{(21)} \quad \text{GER}^w = \lambda p(s,t)\lambda q(s,t) \cdot \left[ p(w) \wedge q(w) \wedge \forall w'[\text{NORM}_w(w') \wedge \text{john-came}(w') \to q(w')]\right]
\]

This predicts that for any gerundive clause this antecedent-consequent relationship holds in terms of the normal world \(w'\). That is, whenever we see a gerundive morpheme, it is presupposed that ‘if \(p\) then \(q\)’ is normal.

The following shows that the gerundive form appears in various kinds of coordinate constructions.

\[
\begin{align*}
\text{(34) a. Mary-wa} & \quad \text{[yasashikute] [kawaii]} \\
& \quad \text{Mary-TOP kind.GER cute.NONPAST} \\
& \quad \text{‘Mary is kind and cute.’}
\end{align*}
\]

\[
\begin{align*}
\text{b. John-wa} & \quad \text{[hon-o yonde] [terebi-o mita]} \\
& \quad \text{John-TOP book-ACC read.GER TV-ACC watch.PAST} \\
& \quad \text{‘John read a book and watched TV.’}
\end{align*}
\]

\[
\begin{align*}
\text{c. John-wa} & \quad \text{keeki-o} \quad \text{[tsukutte] [tabeta]} \\
& \quad \text{John-TOP cake-ACC make.GER eat.PAST} \\
& \quad \text{‘John made and ate the cake.’}
\end{align*}
\]

Since the proposed gerundive meaning has a property of coordinating two propositions, which can be extended to account for these facts by assuming that they are syntactically derived from a clausal source.

\[
\begin{align*}
\text{(35)} \quad & \quad \text{[John-wa keeki-o tsukutte] [John-wa keeki-o tabeta]} \\
& \quad \text{John-TOP cake-ACC make.GER John-TOP cake-ACC eat.PAST} \\
& \quad \text{‘John made and ate the cake.’}
\end{align*}
\]

However, the proposed denotation is not extendable to the case where the clausal coordinate structure is less apparent.

\[
\begin{align*}
\text{(36) a. John-ga} & \quad \text{nete-iru.} \\
& \quad \text{John-NOM sleep.GER-is.NONPAST} \\
& \quad \text{‘John is sleeping.’}
\end{align*}
\]
b. John-ga Mary-ni hon-o yonde-ageta.
   John-NOM Mary-DAT book-ACC read.GER-give.PAST
   ‘John read a book to Mary.’

Although there is a gerundive form in (36), these do not seem to be derived from coordination of two propositions, as the recovered structures below show.

(37) a. [John-ga nete] [John-ga iru].
   John-NOM sleep.GER John-NOM is.NONPAST
   ‘John sleeps and John is there.’
b. [John-ga Mary-ni hon-o yonde]
   John-NOM Mary-DAT book-ACC read.GER
   [John-ga Mary-ni hon-o ageta].
   John-NOM Mary-DAT book-ACC give.PAST
   ‘John read Mary a book and John gave Mary a book.’

Intuitively, nete-iru and yonde-ageta form a complex verb rather than having a clausal source. Once again, one option is to assume lexical ambiguity for the gerundive morpheme.

4.3 The Notion of ‘Normality’

My analysis derived the ‘even if’ meaning from the gerundive construction and mo referring to the notion normality. However, there are some cases in which the same combination of the gerundive clause and mo is interpreted not as ‘even if’ but as part of deontic expression.

   John-NOM come.GER-mo good.NONPAST(POLITE)-yo
   Lit. ‘It is ok for John to come.’/‘John may come.’ (Permission)
   John-NOM come.GER-TOP/CONT disallowed.NONPAST(POLITE)
   Lit. ‘It is not ok for John to come.’/‘John may not come.’ (Prohibition)

At a glance, the notion of normality may not be suitable to account for this kind of modal meaning. Nevertheless, since my account for concessive conditionals is based on the conditional modal analysis, the present approach may account for (38-a) having some way to analyze the meaning of permission.10

10The next further question is why mo cannot appear in (38-b) with the prohibition meaning. Stefan Kaufmann asked me if I would like to analogously extend the analysis of mo to wa in (38-b). At this point, I have no clue, but it will be interesting to investigate the possibility of quantification over possible worlds by the topic/contrastive marker wa.
5 Conclusion

I presented a puzzle in Japanese where the particle *mo* expresses conditionality and unlikeliness. Based on Karttunen and Peter’s (1979) view on ‘even’, the analysis has incorporated Kratzer-Stump style conditional modality to it in order to derive the conditional meaning and the unlikeliness meaning. By doing this in a compositional way, I show how the conjunctive meaning turns into concessive conditionals. The unlikeliness meaning is explained not by the existence of a morpheme that inherently has the ‘unlikeliness’ scalar meaning, but as the interaction between the particle *mo* that has a quantificational force and the gerundive clause that provides the notion of normality.

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Asserted and Implicated Meanings in Catalan \textit{Déu n’hi do}

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Abstract

In this paper, we present an analysis of the semantics and pragmatics of the lexicalized Catalan expression \textit{Déu n’hi do}, which embeds \textit{wh}-clauses, including exclamatives. Interestingly, though, \textit{Déu n’hi do} sentences do not convey extreme degree, they have have different distributional properties than matrix exclamatives, and they usually – but not always – co-occur with an exclamative intonation. We argue that the peculiar properties of \textit{Déu n’hi do} derive from the combination of the assertion and the scalar implicature it conveys, plus the conventional implicature generated by this intonation.

1 Introduction

The goal of this paper is to provide an analysis of the semantics and pragmatics of the Catalan particle \textit{Déu n’hi do} (DND henceforth), as illustrated in (1). As a first intuitive approximation, this particle may be roughly translated in English by the meaning of the adverb \textit{quite} when uttered with an exclamative intonation. As we spell out our analysis, it should become clear why we have chosen this paraphrase.

(1) \textit{Déu n’hi do quin fred que fa!}
\textit{DND} what cold that makes
‘It’s quite cold!’

DND is a linguistically interesting particle for the following three reasons: (1) it is a \textit{wh}-embedding predicate that differs semantically and pragmatically from other \textit{wh}-embedding predicates such as \textit{know} or \textit{it’s amazing}, (2) it selects for \textit{wh}-exclamatives, but it does not indicate extreme degree – which is in principle counter-intuitive – and (3) it shows a complex semantic behavior, conveying meaning at different semantic levels.

Our main claims in this paper are the following: (i) DND does not select for exclamatives or interrogatives, but for \textit{wh}-clauses in general, (ii) DND generates a conversational implicature such that the proposition that is true in the actual world is compatible with the worlds that the speaker considers unusual (but not weird), and (iii) DND
contributes to discourse at both at-issue and conventional implicature (CI) domains of meaning. Furthermore, apart from analyzing the properties of DND, we also argue that there is a complex relationship between different domains of meaning: i.e., only assertions are able to cancel conversational implicatures.

This paper is structured as follows: Section 2 presents some background and previous work on this particle, Section 3 gives an overview of the main properties of DND, Section 4 presents a previous analysis, which we call an exclamative account, and Section 5 presents our current proposal, a non-exclamative account. Finally, Section 6 concludes.

2 Background

DND comes from the lexicalization of the sentence "God gave to you" (see the gloss in (2-a)), which in Old Catalan could be used literally, as shown in (2-b), and in modern Catalan has acquired a figurative meaning. Specifically, it has become an emotive predicate, as illustrated in (2-c) and (2-d).

(2) a. D´eu n’hi do
   God DO.IO give
   ‘Give me some bread that God gave to you.’

b. Doni’m un pa que D´eu n’hi do.
   Give me a bread that DND
   ‘Give me some bread that God gave to you.’

c. Tinc una feina que D´eu n’hi do!
   I have a work that DND
   ‘I have quite a lot of work!’

d. D´eu n’hi do quina feina que tinc!
   DND what work that I have
   ‘I have quite a lot of work!’

As far as its distribution is concerned, DND can appear on its own or it can also take single or multiple wh-questions (cf. (3-a) and (3-b)), wh-exclamatives (cf. (3-c))\(^1\) and DPs (see (3-d)).

(3) a. D´eu n’hi do qui va venir a la festa!
   ‘DND who came to the party!’

b. D´eu n’hi do qui va ballar amb qui!
   ‘DND who danced with who!’

c. D´eu n’hi do que bé que sona!
   ‘DND how good it sounds!’

d. D´eu n’hi do la gent que va venir!
   ‘DND the people who came!’

\(^1\)This embedded clause can only be a wh-exclamative since the wh-word que in Catalan can only introduce wh-exclamatives and, crucially, not wh-interrogatives. Also, note that there is a second que, which is an optional complementizer that also occurs exclusively with exclamatives.
Sancho (2003) has argued that the basic function of DND “is that of emphasis or intensification” (p.157). He has also noted that DND can be followed by an exclamative and he claims that, in such cases, DND “only reinforces constructions which are emphatic by themselves” (p.159). The idea that DND’s basic function is that of intensification is recurrent in the dictionaries that attempt to define it. For example, the classical Catalan dictionary Alcover and Moll (1968-1969) defines DND in the following way: "It is used as an emphatic exclamation, to express the greatness or importance of something or the admiration it produces". Also, in her study of interjections, Cuenca (2002) classifies DND as an expressive interjection which expresses admiration or surprise. In this paper, we will argue against both claims (1) that DND is an intensifier and (2) that DND is semantically redundant when it appears followed by a *wh*-clause. In the next Section, we present some evidence that claims (1) and (2) do not hold.

3 Properties

DND has three interesting properties, which our analysis needs to explain.

**Not-extreme degree.** The first interesting property of DND is that it conveys that an extreme degree has not been reached. Therefore, the discourse in (4-a), in which this lack of extreme degree is explicitly conveyed, is perfectly coherent. This contrasts with the behavior of other emotive predicates and of matrix exclamatives, which are not compatible with an explicit denial of extreme degree, as (4-b) and (4-c) show. The proposals mentioned in the previous Section mistakenly attribute to DND a purely exclamative meaning and, thus, cannot account for cases like (4-a).

\[(4) \begin{align*}
\text{a. } & \text{Déu n’hi do que alt que és. Tanmateix, no és extremament alt.} \\
& \text{‘DND how tall he is. However, he’s not extremely tall.’} \\
\text{b. } & \# \text{It’s amazing how tall he is. However, he’s not extremely tall.} \\
\text{c. } & \# \text{How tall he is! However, he’s not extremely tall.}
\end{align*}\]

Interestingly, the lack of extreme degree can be canceled and, therefore, the discourse in (5-a) is also felicitous. However, there are some restrictions on this cancelation. In particular, it cannot take place within the DND sentence itself (see (5-b)):

\[(5) \begin{align*}
\text{a. } & \text{Déu n’hi do que alt que és! De fet, és extremament alt.} \\
& \text{‘DND how extremely tall he is! In fact, he’s extremely tall.’} \\
\text{b. } & \# \text{Déu n’hi do que extremament alt que és!} \\
& \text{‘DND how extremely tall he is!’}
\end{align*}\]

**Discourse possibilities.** DND can appear in some contexts were matrix *wh*-clauses are not acceptable. For example, DND can answer questions ((6-b)), while *wh*-exclamatives and other emotive predicates cannot ((6-c) and (6-d)).

\[(6) \begin{align*}
\text{a. } & \text{Have you published many papers?} \\
\text{b. } & \text{Déu n’hi do.} \\
\text{c. } & \# \text{It’s amazing.} \\
\text{d. } & \# \text{How many papers I’ve published!}
\end{align*}\]
Additionally, DND can be embedded syntactically in some contexts that do not allow for matrix \textit{wh}-clauses, such as verbs of belief (see (7)):

\begin{equation}
\text{(7)} \quad \text{Crec que *(Déu n’hi do) que guapo que és el seu nòvio!}
\end{equation}

‘I believe that DND how cute her boyfriend is!’

\textbf{Intonation.} The third interesting property of DND is that it usually appears with an exclamative intonation (ExInt, henceforth), but can also appear without it and, in that case, it is pronounced with a plain declarative intonation (see (8)).

\begin{equation}
\text{(8)} \quad \begin{array}{ll}
\text{a.} & \text{La Júlia creu que [Déu n’hi do que guapo que és el seu nòvio!]_{ExInt}.} \\
\text{b.} & \text{La Júlia creu que Déu n’hi do que guapo que és el seu nòvio.}
\end{array}
\end{equation}

‘Júlia believes that DND how cute her boyfriend is.’

We will show in Section 5 how this variation has interesting semantic effects.

\section{An exclamative account of DND}

This section briefly reviews a previous analysis of DND (Mayol, 2007), which captured the lack of extreme degree that DND conveys by using the semantics of exclamatives proposed by Zanuttini and Portner (2003). We first present this analysis, then, we see its application to DND, and we close the section by justifying the need of an alternative.

\subsection{Zanuttini and Porter’s (2003) semantics of exclamatives}

Zanuttini and Portner’s (2003) proposal may be summarized as follows. They posit three elements in order to derive the semantics of exclamatives. Syntactically, exclamatives contain a \textit{wh} operator-variable structure and an abstract factive morpheme FACT. Moreover, there is a process of widening of the domain of quantification of the \textit{wh}-operator. Let us examine each element in turn:

\textbf{(1)} The \textit{wh}-component of the sentence is responsible for creating the denotation of a set of alternative propositions, as in questions (following Hamblin 1973 and Karttunen 1977). Thus, in a context in which we are discussing what chili peppers our friend John likes to eat, the sentence in (9-a) denotes a set of propositions of the form ‘he eats \textit{x},’ with a contextual restriction on the domain of quantification. The current domain of quantification is the set of peppers D1, as specified in (9-b).

\begin{equation}
\text{(9)} \quad \begin{array}{l}
\text{a.} \quad [\text{what things he eats!}]_w = \{p: p \text{ is true in } w \text{ and } \exists x(p = ‘he eats } x\text{’)\} = \{\text{he eats poblanos, he eats serranos, he eats jalapeños}\} \\
\text{b.} \quad D1 = \{\text{poblano, serrano, jalapeño}\}
\end{array}
\end{equation}

\textbf{(2)} Let us turn now to the second ingredient: widening. At an intuitive level, widening makes the domain of quantification bigger so that it includes things we would otherwise not have considered, with more extreme values. More formally, for any clause \textit{S} containing widening, the initial domain of quantification, D1, is widened to a new
domain of quantification, D3. In each domain of quantification D, there is an ordering represented by $[[S]]_{w,D,<}$. The widening process is such that the conditions in (10-a) and (10-b) hold:

(10) a. $[[S]]_{w,D_3,<} - [[S]]_{w,D_1,<} \neq \emptyset$

b. $\forall x\forall y[(x \in D_1 \& y \in (D_3 - D_1) \rightarrow x < y]$

c. $D_3=\{poblano, serrano, jalapeño, güero, habanero\}$

That is, the difference between the widened domain D3 and the regular domain D1 is not empty; D3 adds something which was not in the previous domain D1. Besides, there is a particular ordering in the domains, such that the widened domain, D3, contains more extreme values. Continuing with (9-a), the widened domain D3 is a superset of D1, containing types of peppers with more extreme degrees of spiciness, such as the set in (10-c).

(3) The factive morpheme FACT will introduce the presupposition in (11-a): all the propositions added to the denotation of the clause through evaluation in relation to the widened domain are true. Thus, the sentence in (9-a) has the presupposition in (11-b): John eats the hottest peppers, that is, the ones contained in the widened domain, but not in the regular domain.

(11) a. $\forall p \in [[S]]_{w,D_3,<} - [[S]]_{w,D_1,<}: p$ is true

b. $[[\text{what things he eats!}]]_{w} = \{\text{he eats güeros, he eats habaneros}\}$

4.2 DND exclamative semantics

Mayol (2007) used the semantics of exclamatives that we just presented to capture the lack of extreme value conveyed by DND. This was achieved by introducing a further domain of quantification, D2. The proposal is that DND presupposes that there is another domain of quantification, D2, which is a proper subset of D3 and a proper superset of D1, as defined in (12).

(12) $[[\text{DND-CP}]]_{w}$ is defined iff:

a. $[[\text{CP}]]_{w,D_2,<} - [[\text{CP}]]_{w,D_1,<} \neq \emptyset$

b. $[[\text{CP}]]_{w,D_3,<} - [[\text{CP}]]_{w,D_2,<} \neq \emptyset$

c. $\forall x\forall y\forall z[(x \in D_1 \& y \in (D_2 - D_1) \& z \in (D_3 - D_2)) \rightarrow x < y < z]$

The domain D2 needs to be bigger than D1 (condition (12-a)) and smaller than D3 (condition (12-b)). Also, there remains the ordering in the domains (condition (12-c)), so that D1 contains the least extreme values, D3 contains all values, including the more extreme values, and D2 falls in the middle between the other two domains. For the example in (9-a), this middle domain D2 may look like the set specified in (13-a). The assertion of a DND-clause is given in (13-b). All the propositions added to the denotation when the assignment function is evaluated with respect to D2 (the middle domain) are true.

---

Zanuttini and Portner (2003) call this widened domain D2. It is called D3 here for expository purposes, as it will become clear once Mayol’s (2007) analysis of DND is introduced.
$$D_2 = \{\text{poblano, serrano, jalapeño, güero}\}$$

$$\forall p \in [\text{CP}]_{w,D_2} : \sim [\text{CP}]_{w,D_1} : p \text{ is true}$$

$$[\text{DND what things he eats!}]_w = \{\text{he eats güeros}\}$$

Thus, modifying the example in (9-a) and turning it into a DND-exclamative would yield the assertion in (13-c). That is, the assertion is that John eats mildly spicy peppers, but it says nothing about the habanero, the very spicy pepper which is a member of D3, but not of D2.

Mayol (2007) proposes that there is a further component of meaning, a scalar conversational implicature, given in (14-a): all the propositions added to the denotation when the assignment function is evaluated with respect to D3 are false. That is, there is no extreme widening. Being a conversational implicature, it can be canceled, as was shown in (5-a).

$$\forall p \in [\text{CP}]_{w,D_3} : \sim [\text{CP}]_{w,D_2} : p \text{ is false}$$

Thus, the scalar conversational implicature of the DND-exclamative in (13-c) is that it is false that John eats the habanero, the extremely spicy pepper which is contained in D3, but not in D2.

4.3 Why an alternative?

We present an alternative approach to DND both for theoretical and empirical reasons. From the theoretical side, the notion of widening is not an uncontroversial one. It may be useful to explain the behavior of matrix exclamatives, but it also involves stipulations; for instance, it is be triggered by a null factive morpheme with an ad-hoc interpretation. Along with others (cf. D’Avis 2002; Abels 2005; Castroviejo 2006; Rett t.a.), we would like to explore whether we can do without it and still account for the data. From the empirical side, this proposal does not explain the contribution of intonation and also has nothing to say about the impossible cancelation in (5-b).

5 A non-exclamative account

The proposal we make in order to account for the properties presented in Section 3 aims to be maximally simple. This is why we are not considering wh-interrogatives and wh-exclamatives as being semantically different. Crucially, none of the aforementioned properties hinge on the fact that the wh-clause introduced by DND is a wh-interrogative or a wh-exclamative. For our purposes here, we leave aside their syntactical or morphological differences and we focus on the core semantic features they have in common. In particular, we consider three kinds of meaning that are involved in the utterance of a DND sentence, which will be developed in the following subsections. We first look at DND as a wh-embedding predicate with an at-issue meaning, then we deal with the scalar implicature it generates, and finally we elaborate on the expressive meaning that derives from the usual pairing between DND and exclamative intonation.
5.1 DND as a wh-embedding predicate

In order to understand the meaning that DND contributes to the at-issue dimension (that is, its descriptive or ordinary meaning, cf. Potts 2005), we take as a model Sharvit (2002)’s denotation for the verb surprise in (15).

\[(\text{surprise})^{H/K} (w)(Q)(a) = 1 \text{ iff } \text{NONEXP}(a)(w) \supseteq \{ p : p \in Q(w) \& w \in p \}\]

NONEXP(a) is the complementary set of the set compatible with a’s expectations in w. (15) says that surprise takes as argument a world w, a Hamblin/Karttunen question denotation Q (i.e., a set of propositions) and an individual a and it yields true only if the true answer to the question Q in w is included in the set of unexpected worlds according to individual a. To illustrate it with an example, the paraphrase of (16-a) is in (16-b).

(16) a. It surprises John who came.
    b. For all worlds w, the proposition that truthfully answers the question Who came in w? is not compatible with John’s set of expected worlds.

DND resembles surprise in that the former also takes Q as argument, but rather than expressing unexpectedness, DND indicates that the true answer to the question is unusual. That is why, instead of making use of NONEXP(a), we propose to include in its denotation another predicate, namely UNUSUAL(a). We assume the following: (i) UNUSUAL(a) is the complement set of the set of worlds compatible with what a considers to be standard, and (ii) UNUSUAL(a) is a subset of the set of weird worlds (let us call it WEIRD(a)), such that the material implication in (17) holds, but it does not hold that an unusual world must be a weird one. The denotation for DND we propose, which is adapted from (15), can be seen in (18).

\[\forall w \ [w \in \text{WEIRD}(a) \rightarrow w \in \text{UNUSUAL}(a)]\]

\[(\text{DND})(w)(Q)(a) = 1 \text{ iff } \text{UNUSUAL}(a)(w) \supseteq \{ p : p \in Q(w) \& w \in p \}\]

The restriction imposed on the set of propositions in the formula above is not related to a’s complementary set of expected worlds (i.e., NONEXP(a)), but rather to the complementary set of the set of worlds a considers to be standard (i.e., UNUSUAL(a)). The example in (19-a) can be paraphrased as in (19-b). We should also point out that, since DND is not a verb that can be inflected (unlike surprise), a will refer to the speaker by default. But if DND is embedded in a belief predicate, then a can identify its subject.

(19) a. Déu n’hi do quines coses que menja!
    ‘DND what things he eats!’
    b. For all worlds w, the proposition that truthfully answers the question What things does he eat in w? is not compatible with the speaker’s set of standard worlds.

---

3We assume that when DND appears on its own – for instance when answering a question (see (6-b)) – Q is recovered from context.

4It is not the aim of this paper to go any deeper in the formalization of this predicate. This could be possibly done by appealing to Kratzer (1981)’s notion of ordering source. We thank Cécile Meier (p.c.) for this suggestion, and leave this issue for future research.
The meaning just described is asserted content, which belongs to the at-issue dimension of meaning. Assertions are characterized by (1) their ability to answer questions, and (2) the ability of its content to embed under a predicate like believe, which takes propositions that may be either true or false. Since DND can answer a question ((6-b))\(^5\) and embed under believe ((7)), its descriptive content (as presented in (18)) counts as at-issue meaning and, thus, can be used to make an assertion.

### 5.2 A scalar implicature

In this subsection we show that DND generates a scalar implicature, which conveys that the worlds we are taking into account are those which are compatible with what the speaker considers to be unusual, but not weird. In order to do so, we first take a quick look at a prototypical case of scalar implicature, namely the example of some.

Some is part of a scale which contains other quantificational items such as, for instance, all, which we represent as \(<\text{some, all}>\) (cf. Horn 1972). In these scales, every item logically entails the item on its left and implicates the negation of the item on its right. In other words, if we choose to use some and we are cooperative speakers, we implicate not all. This explains why the follow-up in (20) is perfectly natural, because we understand the first part of the sentence as meaning, by default, that the speaker did not meet all of his/her friends at the party.

(20) I met some of my friends at the party. However, I didn’t meet all of them.

Still, since a scalar implicature is a particular kind of a conversational implicature and a conversational implicature can be canceled, the first part of the sentence in (21) can be followed by another sentence that denies the implicature according to which the speaker did not meet all of his friends at the party, as shown in (21).

(21) I met some of my friends at the party. In fact, I met all of them.

Now, we can draw a parallelism between some and DND. We propose that DND generates a scalar implicature by virtue of it including UNUSUAL. In particular, we understand that \(\text{UNUSUAL}(a)\) is part of a scale of the following form: \(<\text{UNUSUAL}(a), \text{WEIRD}(a)>\). Again, if a world is weird according to \(a\), it must also be unusual, but an unusual world may (but must not) be a weird world. Moreover, the use of a lexical item that incorporates \(\text{UNUSUAL}(a)\) implicates that \(\text{WEIRD}(a)\) does not hold. This explains why we can both reinforce this meaning ((22)) and cancel it ((23)).

(22) Déu n’hi do que alt que és! Tanmateix, no és extremament alt. ‘DND how tall he is! However, he’s not extremely tall.’

(23) Déu n’hi do que alt que és! De fet, és extremament alt. ‘DND how tall he is! In fact, he’s extremely tall.’

In giving a first approximation to the meaning of DND ((1)), we have proposed to use the English adverb quite. In what remains of this subsection we will see that quite resembles

\(^5\)The difference of acceptability between a answer with DND and an answer with it’s surprising is due to the fact that the latter is factive, while the former is not.
DND in also generating a scalar implicature. In fact, quite – which takes as argument a gradable predicate, as in (24-b) – and DND convey similar meanings when the latter takes as argument a degree wh-clause, as in (24-a).

(24) a. DND how tall Pau is!
   b. Pau is quite tall!

Certainly, the compositional semantics of (24-a) and (24-b) is different: whereas (24-a) involves a question denotation, we could paraphrase (24-b) as *Pau is tall to a high degree*. The similarity between DND and quite emerges because asserting that a proposition with a gradable property is unusual amounts to asserting that this property has a high degree. Moreover, quite also generates an implicature, since it is part of the following scale: *<quite, very>*. Hence, when we say that Pau is tall to a high degree, we implicate that this degree is not extreme. That is, quite implicates *not very*. Consequently, just like what happens with DND, we can both reinforce ((25-a)) and cancel ((25-b)) this implicature.

(25) a. Pau is quite tall. However, he’s not very tall.
   b. Pau is quite tall! In fact, he is very tall.

To sum up, we argue that DND asserts that the proposition that is true in the actual world is compatible with the worlds that the speaker considers unusual and conversationally implicates that this proposition is not compatible with the worlds that the speaker considers weird. This is how we capture the lack of extreme degree that DND conveys.

### 5.3 Expressive meaning

Last but not least, DND can convey a third kind of meaning, namely a conventional implicature (CI), in the sense of Potts (2005) and Potts (2007). We propose to derive this effect from the usual co-occurrence of the exclamative intonation (ExInt) and DND (cf. (8)). In particular, we see ExInt as an instance of an expressive item with similar properties as those that characterize *damn* in *The damn machine doesn’t work*. Likewise, intonation takes as input at-issue meaning and returns expressive meaning, even though *damn* combines with a noun and ExInt, with an entire proposition. The meaning contributed at the expressive dimension is expressed in (26).

(26) \( \text{NONEXP}_s(w) \supseteq p \)

In prose, we claim that there is a proposition \( p \) which, crucially, corresponds to the true answer to the question \( Q \) at the at-issue meaning (cf. (18)) and which is incompatible with the set of the speaker’s expected worlds (we are adopting here Sharvit (2002)’s NONEXP predicate to represent the complement set of the set compatible with the speaker’s expected worlds).

In order to show that the information conveyed by intonation is comparable with that of a regular expressive item (i.e., an epithet, a non-restrictive relative clause or a parenthetical), we will go over the properties that Potts (2007) attributes to expressives,
starting from perspective dependence.

Expressive meaning cannot be embedded; that is, it is strictly speaker-oriented. In (27) we see that a DND sentence can embed in a belief predicate (as previously shown in (7)). If we abstract away from ExInt, UNUSUAL(a) is applied to Julia, so the speaker may felicitously contribute that s/he finds this fact unsurprising. However, if the sentence includes ExInt, which involves the speaker’s surprise at the true answer to the question How late did Peter come?, the sentence introduced by but is necessarily contradictory.

(27) La Júlia creu que [Déu n’hi do que tard que ha arribat en Pere (#!ExInt)], però a mi no m’ho sembla.
‘Julia believes that DND how late Peter was!, but I don’t feel this way.’

Also, expressive meaning is nondisplaceable; that is, it expresses something about the utterance situation. We can show that this holds for ExInt, too, by means of the following example:

(28) Déu n’hi do que tard que va arribar en Pere ahir (#!ExInt) Ahir em va sorprendre, però avui ja no.
‘DND how late Peter was yesterday! This surprised me yesterday, but not today.’

In (28), we see that, if the DND sentence includes ExInt, then the follow-up is infelicitous, since the speaker is stating that the meaning conveyed by ExInt belongs to the past and it is not valid at the moment of utterance.

On the other hand, ExInt, like regular expressive items, shows immediacy; that is, it behaves like a performative, which achieves its intended act simply by being uttered. In other words, in using ExInt, the speaker introduces this meaning directly to the addressee’s commitment set (cf. Gunlogson 2003, Bonami and Godard 2008). Crucially, unlike asserted meaning, the content conveyed by ExInt cannot be judged true or false by the rest of the discourse participants. Consider the dialogue below:

(29) a. A: Déu n’hi do que tard que va arribar en Pere ahir!ExInt
   ‘DND how late Peter was yesterday!’
 b. B1: That’s not true. He arrived as usual.
 c. B2: # That’s not true. I don’t think this is unexpected at all.
 d. B3: # That’s true. I also think this is unexpected.

The reply in (29-b) is felicitous, because it is denying assertion conveyed by the DND sentence. Since it concerns the at-issue dimension, the addressee is allowed to judge it before incorporating it to his/her commitment set. In contrast, both the replies in (29-c) and (29-d), which are attempts to judge the meaning conveyed by ExInt true or false, are ruled out.

Finally, expressive meaning exhibits the property that Potts calls independence. This amounts to saying that it can be removed, but the descriptive meaning is still conveyed. Below, we see an example of a DND sentence without intonation, which is still able to make its contribution to the discourse felicitously.
The previous example shows that the at-issue and expressive meanings that DND involves are independent. Why do they co-occur so often, then? This has to do with the fact that DND asserts that something is unusual, on the one hand, and, on the other hand, unusual things are generally (but not necessarily) unexpected. Hence, the utterance of DND and ExInt allows the speaker to convey both things at a time: unusualness and unexpectedness.6

At this point it seems that the division of labor in at-issue, conversationally implicated and conventionally implicated meaning offers a neat picture of the behavior of DND sentences. However, we cannot still account for the contrast in (5) repeated below:

(31) a. D‘eu n‘hi do que alt que és! De fet, és extremament alt.
   ‘DND how tall he is! In fact, he is extremely tall.’

b. # D‘eu n‘hi do que extremament alt que és!
   ‘DND how extremely tall he is!’

To be able to explain the contrast above, we need to make an additional claim; we must pay attention to the kind of meaning that is being used to cancel the scalar implicature in each case. Crucially, in (31-a), the follow-up is a declarative that functions as an assertion. Thus, assertions are able to cancel implicatures. However, following Castroviejo (2008), we take extremely in the particular configuration exemplified by (31-b) to be a non-restrictive modifier. As such, it is a function that takes at-issue meaning as input and returns expressive meaning. In other words, it is a CI item. Our claim is, in fact, that CIs – contrary to assertions – cannot cancel scalar implicatures.7

In order to justify this claim, let us provide additional evidence. For starters, we can show that regular CIs, like non-restrictive relative clauses (aka supplements in Potts 2005), cannot cancel a scalar implicature, either. Consider the examples below:

(32) a. I met a pretty tall boy. In fact, he was extremely tall.

b. #I met a pretty tall boy, who, in fact, was extremely tall/a giant.

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6It is an interesting issue why intonation can be embedded in those cases and not others. We leave the study of this phenomenon for further research and thank Ede Zimmermann (p.c.) for this valuable comment.

7There is another difference between the two cancellations in (31): the latter one does not include the discourse marker in fact, which is syntactically impossible in this configuration (we thank Galit Sassoon for this observation). However, we can reject the possibility that the absence of in fact is responsible for the ungrammaticality of (31-b) on two grounds: first, sentences which do allow for in fact are also unacceptable when a CI is trying to cancel an implicature (cf. (32-b)) and, second, some implicatures can be felicitously canceled even without in fact, cf. (i).

(i) a. John has two or more brothers.
   b. John has two brothers or more.
The contrast between a. and b. shows that only at-issue meaning is able to cancel the implicature generated by pretty according to which the boy is tall, but not extremely tall. This holds even if the two sentences have the same amount of information, but this information is computed at different dimensions of meaning.

Not only this, it appears to be the case that presupposed meaning is also unable to cancel scalar implicatures. See for example (33):

(33) a. Some of my students came to the party. In fact, I believe that all of them came.
   b. # Some of my students came to the party. In fact, I regret that all of them came.

In the examples above, we have the prototypical case of some (cf. Section 5.2 above), which conversationally implicates not all. In the a. sentence, the implicature is canceled by using a follow-up which functions as an assertion. On the other hand, in the follow-up of the b. sentence, the information according to which all of the students came to the party is presupposed and not asserted (the that-clause is embedded under a factive predicate). Note that this presupposed content cannot cancel the implicature. Therefore, this points to a complex relationship between different dimensions of meanings; it is not the case that the weakest meaning (here, the conversational implicature) always disappears; rather, only assertions seem to be able to cancel it.

6 Conclusions

To wrap up, we have shown that Déu n’hi do conveys at the at-issue dimension a meaning similar to quite, which can be canceled, but only by means of another assertion (and not by means of a CI or a presupposition). Also, in combination with an exclamative intonation, Déu n’hi do contributes to the expressive dimension a conventional implicated meaning, roughly, that the proposition about which Déu n’hi do asserts that is unusual is also unexpected.

This being a language-specific phenomenon, we may wonder whether this research is relevant beyond Catalan Déu n’hi do. We strongly believe the answer is yes. First, we have shown that we can account for the properties of embedded wh-clauses with a single semantic denotation: i.e., we can subsume the semantics of interrogatives and exclamatives under a common semantics. We have thus offered additional evidence in favor of an analysis of embedded wh-exclamatives viewed as having the same at-issue content as wh-interrogatives. Second, we have highlighted the semantic role of intonation and have proposed an interpretation for it. And third, we have identified another parameter that characterizes assertions (w.r.t. CIs and presuppositions), namely the ability to cancel conversational implicatures.

Of course, many questions regarding the topics touched upon in this paper remain unanswered. The first one we consider concerns anyone working on expressives: we should formalize and restrict the interactions between the at-issue and the CI dimension. Moreover, it would be interesting to test to what extent Déu n’hi do and other emotive predicates like it’s amazing or you wouldn’t believe differ. And finally, we would like to
find out whether DPs introduced by Déu n’hi do provide any arguments for or against so-called concealed exclamations.

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Two Kinds of Modified Numerals

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Abstract
In this paper I argue that there are two kinds of numeral modifiers: (Class-A) those that express the comparison of a certain cardinality with the value expressed by the numeral and (Class-B) those that express a bound on a degree property.

1 Introduction

The landscape of modified numerals is strikingly diverse. Apart from what I will call comparative quantifiers, like “more than 100”, “fewer than 100”, “less than 100”, “no more than 100”, “no fewer than 100”, etc., there are superlative quantifiers like “at least 100” and “at most 100”; disjunctive quantifiers like “100 or more”, “100 or fewer”, etc.; prepositional quantifiers like the locative “under 100”, “over 100” and “between 100 and 200” and the directional “from 100” and “up to 100”; and a whole range of other quantifiers based on operators expressing a bound, such as “minimally 100”, “maximally 100” or “100 tops”.

Recently, a number of studies have tried to explain this variation. Such investigations usually concern the specific quirks of certain modified numerals.1 While I believe that it is important to have a semantic analysis of modified numerals on a case by case basis, I also believe that what is lacking from the literature so far is a view of to what extent the various modified numerals involve similar semantic structures. In this paper, I will attempt to reach a generalisation along these lines by claiming that there are two kinds of modified numerals: (A) those that relate the numeral to some (specific) cardinality and (B) those that place a bound on the cardinality of some property. The difference will be made clear below. The most obvious examples of (A) are comparative modified numerals like “more/fewer than”. Most other kinds of modified numerals fall in the second class.

1See, e.g., Geurts and Nouwen (2007); Umbach (2006); Corblin (2007); Krifka (2007) on at least/most, Corver and Zwarts (2006) on locative quantifiers, Nouwen (2008a) on directional quantifiers, Nouwen (2008b) on negative comparative quantifiers. See also Nouwen (2008c) for an overview.
I will start by making clear what distinguishes the two classes of modified numerals by presenting a body of data that sets them apart. Then, in section 3, I introduce a well-founded decompositional treatment of comparative quantifiers (Hackl, 2000), which I take to represent the proper treatment of class A modifiers. In section 4, I propose that class B modifiers are operators that indicate maxima/minima. Section 5 concludes by discussing a remaining problem as well as some speculations about which modifiers belong to which class.

2 Class A and class B modified numerals

It is a striking feature of comparative quantifiers that they can be used to assert extremely weak propositions. For instance, (1) is acceptable, even though it expresses a rather under-informative truth.

(1) A hexagon has fewer than 10 sides.

This example contrasts strongly with the examples in (2), which are all unacceptable. (Or, alternatively, one might have the intuition that they are false).

(2) a. #A hexagon has at most 10 sides.
   b. #A hexagon has maximally 10 sides.
   c. #A hexagon has up to 10 sides.

Why is this so? A naive theory might have it that (1) states that the number of sides in a hexagon is strictly smaller than 10 (i.e. $< 10$), and that the only difference with (2) is that, there, it is stated that this number is smaller or equal to 10 (i.e. $\leq 10$). Clearly, 6 is both $< 10$ and $\leq 10$. So why are not both kinds of examples under-informative but true?

Let’s call quantifiers that are acceptable in such examples class A quantifiers and those that are like (2) class B quantifiers. As the contrast between (3) and (4) shows, the distinction is also visible with lower bound quantifiers. That is, (3) is under-informative, yet true and acceptable, while the examples in (4) are unacceptable/false.

(3) A hexagon has more than 3 sides.
(4) #A hexagon has \{ at least / minimally \} 3 sides.

What I think is the underlying problem of examples involving class B expressions is that such quantifiers are incapable of relating to definite amounts. Imagine, for instance, that we are talking about my new laptop and that we are concerned with how much internal memory it has. Say, it has 1GB of memory and that I know that it has so much memory. In case, for instance, you just told me that your laptop has 2GB of memory, then I can assert (5).

(5) I know exactly how much memory my laptop has and it is less than 2GB.

Or, if your computer has a mere 512MB of memory, I can boast that:

(6) My laptop has more than 512MB of memory.
In these examples, I am comparing the definite amount of 1GB to some given contrasting amount 2GB (512MB) by means of “less than” (“more than”). This is something class A quantifiers can do very well, but something that is unavailable for class B modified numerals:

(7) I know exactly how much memory my laptop has...
   a. ...and it is { #at most / #maximally / #up to } 2GB.
   b. ...and it is { #at least / #minimally } 512MB.

In contrast to (7), class B quantifiers are acceptable when what is ‘under discussion’ is not a definite amount, but rather a range of amounts, as in (8).

(8) a. Computers of this kind have { at most / maximally / up to } 2GB of memory.
   b. Computers of this kind have { at least / minimally } 512MB of memory.

In other words, it appear that class B quantifiers relate to ranges of values, rather than to a single specific cardinality. This intuition is supported (9).

(9) Jasper invited maximally 50 people to his party.

We normally interpret (9) to indicate that the speaker does not know how many people Jasper invited. That is, it is unacceptable for a speaker to utter (9) if s/he has a definite amount in mind, which is why the rider in (10) is infelicitous. (Cf. Geurts and Nouwen (2007), Corblin (2007)).

(10) Jasper invited maximally 50 people to his party, #namely 43.

By assuming that the speaker does not know the exact amount, (9) is interpreted as being about the range of values possible from the speaker’s perspective. The speaker thus states that there is a bound on that range. The same intuition occurs if we substitute “maximally 50” by any other class B quantifier.

3 Hackl’s semantics for comparative modifiers

In this section, I discuss the semantics for comparative modified numerals as developed in Hackl (2000). I will assume that this represents the proper treatment of class A numeral modifiers. I also extend the framework slightly by adding a way to account for the ambiguity of non-modified numerals.

3.1 Class A modifiers as degree quantifiers

What is the semantics of a class A quantifier? It is tempting to think that class A quantifiers correspond to the well-known generalised quantifier-style determiner denotations such as the one in (11).

(11) [fewer than 10] = \( \lambda P \cdot |P \cap Q| < 10 \)
In the past decade it has become clear that it is important to have a closer look at these modified numerals (Krifka, 1999; Hackl, 2000). In what follows, I will assume the following semantics of “fewer than”, which is based on the arguments in Hackl (2000).

\[
\text{[fewer than 10]} = \lambda M. \max_n(M(n)) < 10
\]

The workings of this definition will become clear below, but one of the main motivations for an analysis along this line can be pointed out immediately. The semantics in (12) is simply that of a comparative construction, where cardinalities are seen as a special kind of degrees. That is, like the comparative, it involves a degree predicate \( M \) and a maximality operator that applies to this predicate (Heim, 2000). In other words, (12) is completely parallel to other comparatives, like (13).

\[
\text{[shorter than } d\text{]} = \lambda M.\max_{d'}(M(d')) < d
\]

Hackl assumes that argument DPs containing a (modified) numeral always contain a silent counting quantifier “many”:

\[
\text{[many]} = \lambda n \lambda P \lambda Q. \exists x[\#x = n & P(x) & Q(x)]
\]

\[
10 \text{ sushis} \sim [\text{DP [ } 10 \text{ many ] sushis }]
\]

In this framework, the numeral is an argument of the quantifier “many”. By applying [ 10 many ] to the noun (phrase), the standard generalised quantifier denotation of “10 sushis” is derived: \( \lambda Q. \exists x[\#x = 10 & \text{sushi}(x) & Q(x)] \). The structure of a DP containing a modified numeral does not differ essentially. Modified numerals are also the argument of a counting quantifier, as illustrated in (16).

\[
\text{fewer than 10 sushis} \sim [\text{DP [ [ fewer than 10 ] many ] sushis]}
\]

“Fewer than 10”, however, is a (degree) quantifier, not a number constant. Thus, for type purposes, the modified numeral in (16) has to move, leaving a degree trace and creating a degree property.

\[
\text{Jasper ate fewer than 10 sushis.}
\sim [\text{[fewer than 10]} [\lambda n [ \text{Jasper ate } n \text{ many sushis } ] ] ]
\]

This leads to the following interpretation, which results in the desired simple truth-conditions.

\[
[\lambda M.\max_n(M(n)) < 10] (\lambda n. \exists x[\#x = n & \text{sushi}(x) & \text{ate}(j,x)])
= \max_n(\exists x[\#x = n & \text{sushi}(x) & \text{ate}(j,x)]) < 10
\]

If, like degree operators, modified numeral operators can take scope, we expect to find scope alternations that resemble those found with degree operators (Heim, 2000). As Hackl observed, this is borne out by examples like the following.\(^2\) The two readings of (19) are an upper bound reading, and one which is very weak, stating simply that

---

\(^2\)I show here the scope interaction with weak modality. There is a similar interaction with strong modals. The example in (i), for instance is ambiguous with (i-a) and (i-b) as its two readings. See Hackl (2000) for details.
values below the numeral are within what is permitted, without stating anything about the permissions for higher values.

(19) John is allowed to bring fewer than 10 friends.
    a. ‘John shouldn’t bring more than 9 friends’
    b. ‘It’s OK if John brings 9 or fewer friends (and it might also be OK if he brings more)’

Following Heim (2000), Hackl analyses this ambiguity as resulting from alternative scope orderings of the modal and the comparative quantifier.

(20) \[
\begin{align*}
\max_n (\forall x [\# x = n \land \text{friend}(x) \land \text{bring}(j, x)]) < 6 \\
\end{align*}
\]

\[
\begin{align*}
\begin{cases}
&\text{[fewer than 6]} \ [ \lambda n \ [ \text{allow} \ [\text{John invite } n\text{-many friends}]]]
\end{cases}
\end{align*}
\]

(21) \[
\begin{align*}
\diamond (\exists x [\# x = n \land \text{friend}(x) \land \text{bring}(j, x)]) < 6 \\
\begin{cases}
&\text{[allow} \ [\text{[fewer than 6]} \ [ \lambda n \ [\text{John invite } n\text{-many friends}]]]
\end{cases}
\end{align*}
\]

The reader may check that Hackl’s predicted readings in (20) and (21) are indeed the attested ones.

### 3.2 Class B modifiers are different

These analyses are strongly supportive of an approach which treats comparative quantifiers as comparative constructions. The question now is whether class B quantifiers should be given a similar treatment. In other words, will the semantics in (22) do?

(22) \[
\begin{align*}
\begin{cases}
&\text{[up to / maximally / at most / etc... 10]} \iff \lambda M. \max_n (M(n)) \leq 10
\end{cases}
\end{align*}
\]

Choosing a semantics that is parallel to that of “fewer than” is partly unintuitive since the class B quantifiers are not comparative constructions. Yet, cases like “maximally 10” suggest that the crucial ingredient of the semantics is the same, namely a maximality operator. The unsuitability of the analysis in (22) becomes immediately apparent, however, if we investigate examples with class B modified numerals embedded under a weak modal: these turn out not to be ambiguous. Class B modifiers like maximally, up to and at most always yield an upper bound on what is allowed and resist the weaker reading that was found with comparative modifiers.

(23) John is allowed to bring \{ up to / at most / maximally \} 10 friends.
    #But more is fine too.

A further interesting property of the interaction of class B modified numeral quantifiers and modals is that weak modals intervene with the inferences about speaker knowledge that we found for simple sentences. Above, I observed that (24) licenses the inference

(i) \begin{align*}
\begin{cases}
&\text{(Bill has to read 6 books.) John is required to read fewer than 6 books.}
\end{cases}
\end{align*}
\]

\[
\begin{align*}
\begin{cases}
&\text{a. ‘John shouldn’t read more than 5 books’} \\
&\text{b. ‘The minimal number of books John should read is fewer than 6’}
\end{cases}
\end{align*}
\]

For reasons explained in Heim (2000), structural ambiguity arising from degree quantifiers and intensional operators like modals is only visible with non-upward entailing quantifiers.
that the speaker does not know how many friends Jasper invited. In contrast, (25) does not license any such inference; it is compatible with the speaker knowing exactly what is and what is not allowed.

(24) Jasper invited maximally 50 friends.
(25) Jasper is allowed to invite maximally 50 friends.

These observations add to the data separating class A from class B quantifiers. Summarising, the distinctions are then as follows. First of all, class B quantifiers, but not class A quantifiers, resist definite amounts, except when embedded under a weak modal. Second, class B quantifiers, but not class A quantifiers, resist weak readings when embedded under a weak modal.

In the next section I will argue that the peculiarities of class B quantifiers can be explained if we assume that they are quite simply maxima and minima indicators. Basically, what I propose is that the semantics of “maximally” (“minimally”) is simply the operator \( \max_d \) \( \text{min}_d \). This might be perceived as stating the obvious. What is not obvious, however, is how such a proposal accounts for the difference between class A and class B quantifiers. I will argue that the limited distribution of class B modifiers is due to the fact that they give rise to readings that are in competition with readings available for non-modified structures. I will show that, in many circumstances, the application of a class B modifier to a numeral yields an interpretation which is equivalent to one that was already available for the bare numeral. Before I can explain the proposal in detail, I therefore need to include an account of bare numerals in the framework.

3.3 The semantics of numerals

Above, I adopted the semantics of Hackl (2000) for comparative modified numerals. An important part in that framework is played by the counting quantifier \( \text{many} \). I will rename this operator \( \text{many}_1 \), for, in what follows, I assume that for any (modified) numeral there are two counting quantifiers available. These two options are to account for the two meanings of numerals that may be observed: the existential weak lower-bounded meaning and the doubly bound strong meaning. An example like (26), for instance, is ambiguous between (26-a) and (26-b).

(26) Jasper read 10 books.
   a. the number of books read by Jasper \( \geq 10 \)
   b. the number of books read by Jasper = 10

I assume that the meaning in (26-b) is semantic and not the result of a scalar implicature that results from (26-a). See e.g. Geurts (2006) for a detailed ambiguity account, and for some compelling arguments in favour of it.

In the current framework, that of Hackl (2000), the weak reading in (26-a) is due to a weak semantics for the counting quantifier: i.e. \( \text{many}_1 \). I propose that the strong reading, (26-b), is accounted for by an alternative quantifier \( \text{many}_2 \) (taking inspiration from Geurts (2006)).
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Not only does this option suffice to account for the ambiguity of bare numerals, it is moreover harmless with respect to the semantics of comparative quantifiers. That is, it is important to note that the account of the ambiguity of bare numerals does not predict further ambiguities to arise for modified numerals, since such ambiguities do not appear to exist. It is instructive to see in somewhat more detail why the availability of two counting quantifiers changes nothing for our account of comparative quantifiers. The structure in (28) is exemplary of any simple sentence with a modified numeral. As explained earlier, the modified numeral applies to the degree predicate that is created by moving the quantifier out of the DP.

Of course, the denotation of the degree predicate depends on which of the two counting quantifiers is chosen. The predicate in (29) is the result of a structure containing many\(_1\); the predicate in (30) is based on many\(_2\). If, in the actual world, Jasper read 10 books, then (29) denotes \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}. When, however, the predicate contains the many\(_2\) quantifier, the denotation is a singleton set: \{10\} if Jasper reads 10 books. This is because only the maximal group of books read by Jasper is such that it is the unique group of that kind of a certain cardinality. In general, the many\(_2\)-based degree predicate extension is a singleton set containing the maximum of the values in the denotation of the many\(_1\)-based degree predicate.

As discussed above, comparative quantifiers involve maximality operators. However, the maximal values for degree predicates like (29) and (30) are always equivalent. In simple sentences based on a structure like (28), the option of having two distinct counting quantifiers does therefore not result in any ambiguity.

When we turn to cases where the degree predicate is formed by moving the modified numerals over a strong modal operator, something similar can be observed. If Jasper is required to read (exactly) 10 books, then the structure in (31) yields, again, the set \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}. Once more, the structure which contains the bilateral counting quantifier, the one in (32), yields the set containing the maximum of its weaker counterpart.

Given that the relation between (32) and (31) is once again one of a set and its maximal value, no ambiguities can be expected to arise when comparative quantifiers are applied to these two predicates. This is as is desired.
Of course, it could be that the actual situation is not one containing a specific requirement, but one with for instance a minimality requirement. Say, for instance, Jasper has to read at least 4 books. In that case, (32-a) denotes the set \( \{1, 2, 3, 4\} \). The extension of (32-b), however, is the empty set. (In such a context, there is no specific \( n \) such that Jasper has to read exactly \( n \) books.) Clearly, the maximal value for the predicate is undefined in such a case. This means the LF based on \( \text{many}_2 \) will not lead to a sensible interpretation and, so, we again do not expect to find ambiguity.

The case of predicates that are formed by abstracting over a weak modal operator is illustrated in (33) and (34). If Jasper is allowed to read a maximum of 10 books, then the two predicates are equivalent, both denoting the set \( \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\} \).

\[
\begin{align*}
(33) & \quad \lambda d. \forall x[\#x = d \land \text{book}(x) \land \text{read}(j, x)] \\
(34) & \quad \lambda d. \exists! x[\#x = d \land \text{book}(x) \land \text{read}(j, x)]
\end{align*}
\]

In sum, the option of two counting quantifiers \( \text{many}_1 \) and \( \text{many}_2 \) is irrelevant when combined with a comparative quantifier. This is because the comparative quantifier is based on maximality and the degree predicates containing the different counting quantifiers do not differ in their maximum value.

### 4 The semantics of class B quantifiers

I now turn to the main proposal: class B quantifiers are maxima/minima indicators. I start with the upper-bounded modifiers.

#### 4.1 Upper bound class B modifiers

In the formula in (35) \( \text{MOD} \) generalises over any of the class B modifiers “at most”, “maximally”, “up to”, etc.

\[
(35) \quad [\text{MOD}] = \lambda d. \lambda M. \max_n(M(n)) = d
\]

If the semantics of upper bound class B quantifiers is as in (35), then why is their distribution so limited? What I think is the reason for the awkwardness of a lot of examples with class B quantifiers is the fact that in many cases (35) is a vacuous operator. I think it will be important to find out for which degree predicates \( M \), stating that \( \max_d(M(d)) = n \) is equivalent to simply stating \( M(n) \). The easy answer is that this equivalence holds when \( M \) denotes a singleton set. This observation has profound consequences for when it actually makes sense to state that the maximum of a degree predicate equals a certain value. To see this let us carefully go through the following examples.

We know from the discussion above that one of the interpretations available for (36) is (37).

(36) Jasper invited 10 people.

---

3If there is in addition a lower bound, the two predicates are no longer equivalent, but their maximum will be.
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(37) \( \exists ! x [ \# x = 10 \& \text{people}(x) \& \text{invite}(x)] \)

Now consider (38), which is interpreted either as (39) or as (40).

(38) Jasper invited maximally 10 people.

(39) \[ \text{maximally 10} \left[ \lambda d \left[ \text{Jasper invited } d \text{ many}_1 \text{ people} \right] \right] \]
\[ \sim \max_n(\exists x[\# x = n \& \text{people}(x) \& \text{invite}(j,x)]) = 10 \]

(40) \[ \text{maximally 10} \left[ \lambda d \left[ \text{Jasper invited } d \text{ many}_2 \text{ people} \right] \right] \]
\[ \sim \max_n(\exists ! x[\# x = n \& \text{people}(x) \& \text{invite}(j,x)]) = 10 \]

The interpretations in (39) and (40) are equivalent. In fact, just like we do not expect ambiguities to arise with comparative quantifiers on the basis of the many\(_1\)/many\(_2\) choice, we do not expect any ambiguities to arise with upper-bound class B quantifiers, for the simple reason that both such operators involve a maximality operator and that the maximal values of predicates based on many\(_1\) are always those of predicates based on many\(_2\).

In what follows, we will therefore gloss over the two equivalent options by representing the semantics following the general scheme in (41).

(41) \[ \text{maximally 10} \left[ \lambda d \left[ \text{Jasper invited } d \text{ many}_{1/2} \text{ people} \right] \right] \]
\[ \sim \max_n(\exists (!) x[\# x = n \& \text{people}(x) \& \text{invite}(j,x)]) = 10 \]

Importantly, the single reading of (38) is equivalent to (37), the strong reading of (36). The example in (36), however, reaches this interpretation by means of a much simpler linguistic form; one which does not involve a numeral modifier. I propose that this is why the reading in (41) of (38) does not surface: it is blocked by (36).

As observed above, we can nevertheless make sense of (38) once we interpret the sentence to be about what the speaker holds possible. So, a further possible reading for (38) is that in (42).

(42) \[ \max_n(\Diamond \exists (!) x[\# x = n \& \text{people}(x) \& \text{invite}(j,x)]) = 10 \]

Crucially, this interpretation is not equivalent to (43), which is the result of interpreting (36) from the perspective of speaker possibility.

(43) \[ \Diamond \exists ! x[\# x = 10 \& \text{people}(x) \& \text{invite}(j,x)] \]

In other words, the meaning in (42) for (38) is not blocked by the bare numeral form in (36) since (36) lacks this reading.

What is crucial is that degree predicates based on weak modals denote non-singleton sets even when the counting quantifier associated with the numeral is many\(_2\). This entails that saying that the maximum value for such a predicate is \( n \) is not equivalent to saying that the predicate holds for \( n \). As a result, whenever an upper bound class B modifier scopes over a weak modal, no blocking from the simpler bare numeral form will be able to take place. In other words, the application of an upper bound class B quantifier to a degree predicate is only felicitous if the resulting readings are not readings that can be expressed just as well by omitting the class B modifier. This is the case when a weak modal has scope inside the degree predicate.
Treating upper bound class B quantifiers as maxima indicators also explains why in the interaction with weak modality, no weak meanings occur. Consider (44).

(44) Jasper is allowed to invite maximally 10 people.

If “maximally 10” is taken to have wide scope over the modal, then we arrive at the reading that says that the maximum number of people Jasper is allowed to invite equals 10. This is not a semantic interpretation that is available for (45). Its many_2 reading, for instance, says that inviting exactly 10 people is something that Jasper is allowed to do. This is much weaker than our interpretation for (44). The only way we can arrive at an equally strong reading for (45) is by means of implicature.

(45) Jasper is allowed to invite 10 people

Given the fact that (45) yields weak semantic meanings, (44) lacks such weak meanings. If we take the modal in (44) to have widest scope, the resulting interpretation is one in which inviting exactly 10 people is allowed for Jasper. This is the reading for (45) discussed above, and so it is blocked.

An interesting side to the account presented here is that the upper bound class B quantifiers do not encode the ≤ relation. As maxima indicators, their application only makes sense if what they apply to denotes a range of values. Otherwise, using the strong reading of the bare numeral form will do just as well.

4.2 Lower-bound class B modifiers

Lower-bound class B modifiers correspond to minimality operators. Let MOD correspond to any of the class B expressions at least, from, minimally, etc.

(46) \[ [\text{MOD}] = \lambda d. \lambda M. \min_n(M(n)) = d \]

Note first that minimality operators are sensitive to the many_1 / many_2 distinction. Say, we once more consider the degree predicate [\lambda d. John read d many_1/2 books] and, say,

4Interestingly, the approach also predicts that some of the examples I discussed above do not only result in a blocking effect, but could moreover be predicted to be false. For instance, according to the approach set out above, the meaning of (i-a) is that in (i-b).

(i) a. #A triangle has maximally 10 sides.
   b. ‘the maximum number of sides in a triangle is 10’

The reading in (i-b) is not only blocked by “A triangle has 10 sides”, but it is moreover plainly false. I believe that this predicts that (i-a) should be expected to have a somewhat different status from (ii), which strictly speaking has a true interpretation, but one that can be expressed by simpler means.

(ii) #A triangle has maximally 3 sides.

It is difficult to establish whether this difference in status is borne out, or even how this difference can be recognised. However, my own intuition tells me that while (i) is never acceptable, (ii) could be used in a jokingly fashion. Native speakers inform me that (iii) is marginally acceptable:

(iii) “?A triangle has minimally and maximally 3 sides”.
that John read 10 books. In the many$_1$ version of the LF, the minimal degree equals 1. In fact, independent of how many books John read, as long as he read books, the minimal degree will always be 1. In the many$_2$ version of the LF, the predicate denotes a singleton set, $\{10\}$ if John read 10 books. The minimal degree in that case is, of course, 10.

These observations already straightforwardly account for our intuitions for an example like (47).

(47) John read minimally 10 books.

The many$_1$ LF of (47) will be rejected, for it will always be false. The minimal value for any simple many$_1$-based degree predicate is always 1. The many$_2$ LF of (47) will be rejected too, for it will correspond to an interpretation saying that John read (exactly) 10 books. This reading is blocked by the bare numeral. (In fact, (47) in the many$_2$ variant is equivalent to John read maximally 10 books, which is equally blocked.)

We can save (47) by sticking in a weak modal. This yields two readings:

(48) a. $\min_d(\diamond \exists x[\#x = d & \text{read}(j,x) & \text{book}(x)]) = 10$

b. $\min_d(\diamond \exists! x[\#x = d & \text{read}(j,x) & \text{book}(x)]) = 10$

The form in (48-a) is once more a contradiction: the minimal degree for which it is deemed possible that John read $d$-many books is always 1. The reading in (48-b) is much more informative. It says that that the minimal number for which it is thought possible that John read exactly so many books is 10. In other words, this says that it is regarded as impossible that John read fewer than 10 books. This is exactly the reading that is available.\(^5\)

5 Outlook and conclusion

The analysis presented in the last section is just the tip of the iceberg. In fact, beyond what I have shown so far loom some problems which are hugely problematic. As Hackl (2000) observed, there is an interesting interaction between modified numerals and modals. I have extended these observations by showing how weak modals have a tight connection to class B modifiers in that they license their (otherwise blocked) existence. What I have not discussed at all is how class B modifiers interact with strong

\(^5\)Some words are in order on the interaction of numeral modifiers with non-modal operators. Given the current proposal, any property that involves existential quantification would license the use of a class B modifier. However, it is known that degree operators (which we take modified numerals to be) cannot take scope over nominal quantifiers (see for instance Heim (2000)). This explains why (i) does not have the reading in (ii).

(i) Someone is allowed to invite maximally 50 friends.

(ii) the person who is allowed to invite most friends is allowed to invite 50 friends

As observed above, however, bare plurals do interact with class B quantifiers, as in for instance example (8). This would suggest that some intensional/modal analysis of the readings involved in such examples is in order. (Thanks to Maribel Romero for pointing this out to me.) At this point, however, I have no worked out theory of how to deal with such examples in detail.
modals. It turns out that this part of the story is not straightforward at all.\footnote{There is a precedent. In an earlier theory of “at least”, Geurts and Nouwen (2007), the correct predictions regarding its relation to strong modals are arrived at by an essentially non-compositional mechanism. Krifka (2007) deals with this issue in a similarly non-standard way.} To sketch the problem, consider (49).

\begin{equation}
(49) \quad \text{To please his mother, John should read minimally 10 books.}
\end{equation}

According to my proposal, (49) means the following: 10 is the minimal number of books such that in every world in which John pleases his mother, John reads that number of books. This makes no sense. Say that we are in a situation in which John’s mother is pleased in case John reads 5 or more books. In such a situation, every world in which John pleases his mother is a world in which John reads (at least) 5 books. Yet, every such world is also a world in which John reads a book. This means that the minimal number of books read in every \textit{pleased-mother} world is 1 and not 5. In fact, in any situation, this minimal number will be 1.

The proposal, then, makes the wrong prediction: (49) is predicted to be nonsensical, when in reality it has a clear and intuitive meaning.

Nevertheless, I think that this problem does not undermine the proposal above. The reason is that the same problem occurs with different examples, that are completely independent of modified numerals. According to my theory, (49) means exactly the same as (50).

\begin{equation}
(50) \quad \text{The minimal number of books John must read to please his mother is 10.}
\end{equation}

This example wears its semantic analysis on its sleeve: (50) corresponds to (51).

\begin{equation}
(51) \quad \min_d(\square \text{please John’s mother} \exists x[\#x = d \& \text{book}(x) \& \text{read}(j, x)]) = 10
\end{equation}

The example in (50) does not have a modified numeral in it. Still, its analysis, that of (51), runs in exactly the same trouble as did my proposal for (49): the form in (51) is non-sensical, for the minimal $d$ alluded to will always be 1. I conclude from this that the problem is evidence for a puzzle which is independent of modified numerals, one which involves the interaction of modality and degree generally. Until we solve this bigger puzzle, there is no point in passing judgement on the current proposal.

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The main point of this paper is that there are two kinds of modified numerals. I leave it an open question exactly which quantifiers belong to which class. Nevertheless, I can already offer some speculations on this. Class A, for instance, could very well contain non-comparative quantifiers. Possible candidates are certain locative prepositional modifiers. Compare (52-a) and (52-b).

\begin{enumerate}
\item \textbf{a.} You can get a car for under 1000 euros.
\item \textbf{b.} You can get a car for maximally 1000 euros.
\end{enumerate}

The example in (52) is somewhat strange, since it claims that the most expensive car you can buy is 1000 euros. The example in (51), in contrast, makes no such claim. It clearly
has a weak reading: there are cars that are cheaper than 1000 euros and there might be more expensive ones too. Such weak readings occur with class A and not with class B quantifiers. Furthermore, “under” seems perfectly compatible with definite amounts, such as in (53).

(53) The total number of guests is under 100. (To be precise, it’s 87.)

Class A is then not restricted to comparative constructions only. In fact, other locative prepositions seem to behave similarly to “under”.

(54) The total number of guests is between 100 and 150. (It’s 122.)

The locative complex preposition “between . . . and . . .” contrasts with its directional counterpart “from . . . (up) to . . .”, which behaves like a class B modifier: it is incompatible with definite amounts, as in (55), but felicitous if it relates to a range of values.

(55) #The ticket to the Stevie Wonder concert that I bought yesterday cost from €100 to €800.

(56) Tickets to the Stevie Wonder concert cost from €100 to €800.

“Over” parallels “under”. In (57), “over 100” is clearly relating the precise weight 104kg with 100kg. Note in (58) how this contrasts with the directional “100 . . . and up”, which is made felicitous by embedding it under a weak modal.

(57) He weighs over 100 kg. To be precise, he weighs 104 kg.

(a) #He weighs 100 kg and up.

(b) He is allowed to weigh 100 kg and up.

Data like these suggest that even more generalisations about the two kinds of modified numerals are still to be discovered. (It seems, for instance, that locative prepositions end up as class A modifiers, whereas directional ones are members of class B). Just like the precise formulation of how to account for the interaction of modifiers and strong modality, however, a detailed investigation of the generalisations governing the class A/B divide is left to further research.

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Topics and Corrections

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Abstract

In corrections a focus in the first conjunct is corrected by an alternative in the second conjunct. In German, the focus in the first conjunct is usually c-commanded by the negative marker. However, if the focus is a VP focus containing a definite object (DO), that DO can also occur before the negation. The paper argues that in these cases the DO is situated above the negation because (a) it is a sentence topic and is forced to move out of the focus domain (= the c-command domain of the negation), (b) as a topic, it serves as a salient antecedent for an implicit topic in the second conjunct, which that conjunct is still about, (c) the implicit topic is interpreted on the basis of a variable in the syntax, which is resolved by the context. In cases where the DO occurs below the negation, in contrast, the DO is not a topic and the second conjunct is not about the referent of that DO anymore.

1 Introduction

In corrections, the corrected element and the substitute offered for it are usually considered foci (Drubig 1994; Krifka 2006). (1a) is an example with direct object (DO) foci, (1b) has VP foci. The foci are marked prosodically. Pitch accents are indicated by small caps.

    b. John didn’t [VP drink Cider Foc] but [VP ate Chowder Foc].

The second conjunct is elliptic, and corresponds to the size of the focus (Lang 1984). The negation in corrections can take positions different from normal clausal negation, cf. McCawley (1991) for English, see (2) for a variant of (1a).

(2) John drank not vodka but cider.
In German, the negative marker usually\(^1\) c-commands the corrected element in the first clause (cf. Jacobs 1982, 1991; Drubig 1994; Repp 2006, 2009), see (3a). The normal order in non-corrections, where the DO precedes the negation, see (4), is ungrammatical in corrections, see (3b).

    Hans has not the Pinot drunk but the Rioja
    'Hans did not drink the Pinot but the Rioja.'

(4) Hans hat den Pinot nicht getrunken.
    'Hans did not drink the Pinot.'

Ordering restrictions in corrections so far have only been investigated for narrow DP focus (Jacobs 1982, 1991; Drubig 1994), and, to some extent, for wide focus on the clause, as well as multiple narrow foci (Repp 2006, 2009). This paper concentrates on VP focus in German, where the generalization that the negation must c-command the focus no longer seems valid: (5) and (6) are minimal variants where the second conjunct indicates that they are instances of VP focus but where the position of the negation w.r.t. the DO varies: in (5) the negation c-commands the DO, in (6) it does not.

(5) A few years ago Paul wanted to go on a trip around the world but didn’t have enough money. Paul thought about selling his old Buick to a collector but didn’t really want to part with his favourite.
    Am Ende hat er nicht das Auto verkauft,
    at.the end has he not the car sold
    sondern sich bei seiner BANK erkundigt.
    but REFL at his bank enquired
    'In the end he didn’t sell the car but enquired at his bank.'
    They gave him a loan with fair conditions and he could go on his trip.

(6) A few years ago, Paul had an accident with his old Buick, which got damaged pretty badly. Paul thought about selling it to a collector but didn’t really want to part with his favourite.
    Am Ende hat er das Auto nicht verkauft,
    at.the end has he the car not sold
    sondern sich bei seiner WERKstatt erkundigt.
    but REFL at his garage enquired
    'In the end he didn’t sell the car but enquired at his garage.'
    They made him a fair price and he got the car repaired.

\(^1\) An element in Spec,CP or C can be contained within the scope of a negation below C, see (i), which is a case of clausal focus (cf. Jacobs 1991, Repp 2009).

(i) Peter ist nicht dumm, sondern Maria ist unfähig.
    Peter is not stupid but Maria is incompetent
    'Peter is not stupid – Maria is incompetent.'
Obviously, the two examples occur in different contexts, and, importantly, (5) cannot
occur in the context of (6), and vice versa.

In this paper, I will argue that despite first appearances, the second conjunct in
cases like (5) and (6) is a reliable indicator for the size of the focus, i.e. these examples
are clear instances of corrections with VP focus. I will follow assumptions made inter-
alia in Hinterhölzl (2006) and Repp (2009), according to which the negative marker
marks the border of vP and that diverging surface orders are derived by movement of
the subject to Spec,IP (and possibly further), and for objects, by scrambling. I assume
that this is also valid in corrections. I will argue that the difference between (5) and (6)
is one of information structure: in (6), which is the surprising case from the point of
view of focus marking in corrections, the DO has left the c-command domain of the
negation because it is a topic (in the aboutness sense Reinhart, 1981), and therefore has
to leave the focus domain, which corresponds to vP. As a topic, it serves as a salient
antecedent for an implicit topic in the second conjunct, so the second conjunct is still
about the same topic. In (5), in contrast, the DO does not to leave the c-command of
the negation because it is not topical, and is not picked up in the second conjunct.

2 The topic in the first conjunct

There are two types of evidence that feed the assumption that a DO which has scram-
bled out of the c-command domain of the negation in a correction with VP focus is
topical. One type is the context – left and right – of the sentence the DO occurs in, and
the other type is the syntactic and semantic characteristics the DO has if it occurs out-
side the c-command domain of the negation, which I will show are those of a sentential
aboutness topic. I will discuss these characteristics in subsection 2.1 and then move on
to questions of context in subsection 2.2

2.1 Topic characteristics of the direct object in the first conjunct

The claim I will argue for in this subsection is that the DO in the first conjunct of a
correction with VP focus must be a sentence topic in the aboutness sense (Reinhart
1981), if it is to move out of the c-command domain of the negation. There is syntactic
and semantic evidence supporting this claim. As for the syntax of sentence topics in
German, Frey (2004) argues that in the middle field, they are situated above sentential
adverbs. This is illustrated in (7) (from Frey 2004: 158). The context makes Maria
topical: the speaker will say something about her. The DP Maria must occur above the
sentential adverb wahrscheinlich ('probably').

(7) I tell you something about Mary:
      next year will Mary probably to London go
   b. #Nächstes Jahr wird wahrscheinlich Maria nach London gehen.
'Next year Mary will probably go to London.' In a correction with VP focus where the DO occurs before the negation, we find that the DO has to appear before the sentential adverb, which suggests that we are dealing with an aboutness topic:

(8) a. Am Ende hat er das Auto glücklicherweise nicht verkauft, ...
    at.the end has he the car luckily not sold
b. #Am Ende hat er glücklicherweise das Auto nicht verkauft, ...
    ...sondern sich bei seiner Werkstatt erkundigt.
   'In the end he luckily didn't sell the car ...but inquired at his garage.'

For the order where the negation precedes the DO, this test is not informative because sentential adverbs precede the negative marker in German.

As for the semantics of aboutness topics, it was suggested by Ebert & Endriss (2004), and Endriss (2006) that certain quantifiers can, but others cannot occur in topic positions: singular indefinites, bare numeral quantifiers and the quantifier einige N ('some N') can be topical; modified numeral quantifiers and negative quantifiers cannot. How do these quantifiers fare in corrections with VP focus? The results seem to be mixed. We find that increasing quantifiers can occur in the purported topic position (see (9)) whereas decreasing quantifiers cannot (see (10)) - to appreciate the grammaticality status of (10) make sure you interpret the whole coordination. On its own, the first conjunct is fine).

(9) Paul ist Töpfer mit eigenem Brennofen. Sein Nachbar, der auch die Töpferei betreibt, hat sich eine neue Brennanlage gekauft. Paul ist ein neugieriger Mensch. (Paul is a potter with his own kiln. His neighbour, who is also a potter, just got a very modern burning system. Paul is a very curious guy.) Gestern hat er Eine/einige/ mehr als 10 (n) Vase nicht im eigenen Ofen gebrannt ..., yester- has he one/some/ more than 10 (s) the vase not in. own kiln burned day ...sondern die Anlage des Nachbarn ausprobiert. but the system of.the neighbour tried.out
   'Yesterday he burnt {one/some/more than ten} vase(s) not in his own kiln but tried out the neighbour's system.'

(10) Paul is a potter with his own kiln. His neighbour, who is also a potter, just got a very modern burning system. Paul is a very curious guy. But he is also very cautious.
   *Gestern hat er höchstens Vasen nicht im eigenen Ofen gebrannt, 
   yesterday has he at.most 3 vases not in.the own kiln burned 
   ...sondern die Anlage des Nachbarn ausprobiert.
   'Yesterday he burnt at most 3 vase(s) not in his own kiln but tried out the neighbour's system.'
Now, Endriss (2006) makes the following subtle difference between monotone increasing quantifiers and non-monotonic (e.g. exactly three students) quantifiers on the one hand, and monotone decreasing quantifiers on the other. Whereas she judges the former to sound 'extremely odd' in the position above Frey's sentence adverbial, the latter result in entirely ungrammatical sentences. Example (11a) shows that closer scrutiny of increasing quantifiers in non-corrections – i.e. careful control of the discourse context – reveals that they can occur in Frey's topic position here as well, i.e. they do not necessarily sound 'extremely odd' in non-corrections. Importantly, decreasing quantifiers cannot be ameliorated in the same way, as is shown in (11b).

(11) Paul deals in vases. He is always out at pottery fairs and tries to secure the best deals.

a. Last week something strange happened.
   Paul hat mehr als 20 Meissner Vasen überraschenderweise
   einem verhassten Konkurrenten überlassen.
   Paul has more than 20 Meissen vases surprisingly
   a.DAT hated competitor left
   'Paul surprisingly left more than 20 Meissen vases to a hated competitor.'

b. Last week we thought that he would lose several deals. But luckily he didn't.
   *Paul hat höchstens 3 Meissner Vasen zum Glück...
   Paul has at.most 3 Meissen vases to luck
   b'' Paul hat zum Glück höchstens 3 Meissner Vasen...
   ...einem verhassten Konkurrenten überlassen.
   'Paul luckily left at most 3 Meissen vases to a hated competitor.'

Ebert & Endriss (2004) exclude decreasing quantifiers as topics because they cannot form 'sensible representatives' for a discourse referent: their minimal witness set (Barwise & Cooper, 1982) is the empty set, which is not a sensible representative. For the other quantifiers, the minimal witness set provides a sensible representative (in the case of more than ten vases, a sum individual of ten vases). Their often-observed infelicity in topic positions is put down by Ebert & Endriss (2004) to a condition on anaphoric reference: the anaphoric potential (ten vases vs. more than ten vases) must not change when the topic referent is created on the basis of the minimal witness set.

The above observation that in some environments increasing quantifiers are perfectly grammatical indicates that the condition on the minimal witness set is appropriate whereas the other condition needs some more thought. The examples need to be better controlled pragmatically. In the right context, with the right sentence adverbial, the results are different from what Ebert & Endriss (2004) suggest. I cannot go into the details of this here. For the purposes of the present paper I conclude that the scram-

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2 Ebert & Endriss (2004) and Endriss (2006) generally uses examples with low numerals, e.g.
(i) ?? Während des Vortrags haben mehr als drei Studenten interessanterweise geschlafen.
   'During the talk more than three students were asleep, interestingly. (cf. Endriss 2006: 42)
I agree with the judgements they give. It seems however, that the sentence pragmatically is odd – it seems that 3 students must be some relevant threshold in order to make it plausible to say that it is
bled DO in corrections, which I claim to be a topic, behaves like other topics in 'ordinary' topic test environments. Thus, the syntactic and semantic characteristics of the scrambled DO in the first conjunct suggest that it is a sentence topic. Let us now move on to the question of context.

2.2 The left and right context

Returning to the examples in (5) and (6) in the introductory section – which for ease of exposition I repeat here – we find that the left context on its own does not help us much to distinguish between them. Both contexts introduce the car – which warrants the use of the definite DP here – so in both contexts the car could be topical, in the sense of an active discourse referent (see fn. 5 p. 399 for more on this):

(5) A few years ago Paul wanted to go on a trip around the world but didn’t have enough money. Paul thought about selling his old Buick to a collector but didn’t really want to part with his favourite.
   Am Ende hat er nicht das Auto verkauft, at.the end has he not the car sold
   sondern sich bei seiner BANK erkundigt.
   but REFL at his bank enquired
   'In the end he didn't sell the car but enquired at his bank.'
   They gave him a loan with fair conditions and he could go on his trip.

(6) A few years ago, Paul had an accident with his old Buick, which got damaged pretty badly. Paul thought about selling it to a collector but didn’t really want to part with his favourite.
   Am Ende hat er das Auto nicht verkauft, at.the end has he the car not sold
   sondern sich bei seiner WERKSTATT erkundigt.
   but REFL at his garage enquired
   'In the end he didn’t sell the car but enquired at his garage.'
   They made him a fair price and he got the car repaired.

Obviously, the discourse topic in the two examples is different. Whereas the discourse in (5) is about Paul's trying to find enough money to go on a world trip, (6) is about Paul's deciding what to do with his damaged car. These discourse topics are carried through in the subsequent discourse, which in (5) is about finding money, and in (6) about the damaged car: enquiries at banks usually, and also in this case, are about money; enquiries at garages are usually about cars, and in this case can be inferred to have been about the car in question, say about prices, or about the availability of spare parts.

interesting that more than 3 students were asleep. With higher numbers such thresholds are easier to motivate, see (ii), although I suspect that an appropriate context could also license a 'low' threshold.

(ii) Während des Vortrags haben mehr als 700 Studenten interessanterweise geschlafen.
Thus, in (6) it is the car that remains topical throughout – the second conjunct of the correction is still about the car – whereas in (5) this is not the case. Now, the difference in structure between the two examples is that the DO das Auto ('the car') in (5) is in the c-command domain of the negation and in (6) it is not. So what we find is that if the referent of the DO the car remains topical in the second conjunct the DO must leave the c-command domain of the negation.

The following naturally occurring example illustrates the same point. It is from an online blog of pet lovers, where a cat owner relates her experiences with a vet.

(12) *In the evening, after the x-ray was done, the vet called me into the surgery and showed me the x-ray photograph. She said that it didn’t look good and that it was FIP (feline infectious peritonitis) or something else. To find out, she would have to get liquid from my cat’s belly. She gave her an anesthetic and after 5 minutes called me back into the surgery. She had a syringe with a yellow liquid in her hand and said that it definitely was FIP. That there was no cure. I read the report on catgirl.de. It says that there is a 50% chance for it being something else. I would like to know if I should go to a different vet or if I should do more tests like a blood test or a scan. [I am also convinced, that …] [Ich bin auch überzeugt davon, dass …]

meine Tierärztin die Flüssigkeit nicht untersucht hat.
my vet the liquid not examined has
sondern anhand der Farbe die Diagnose gestellt hat.
but from the colour the diagnosis made has

'… my vet didn’t examine the liquid but gave the diagnosis on the basis of the colour.'

She wanted to put my cat down immediately.

In this example, die Farbe ('the colour') referred to in the second conjunct is an inalienable property of something contextually present, which in the present context is to be inferred the liquid – the referent of the DO of the first conjunct. Thus, the second conjunct in this correction is still about that liquid. Note that the DO in the first conjunct is not in the c-command domain of the negation and what is more, the sentence would be deviant, if it were: I suggest that this is because there is no salient entity in the wider context whose colour could serve as the basis for the diagnosis in question, which means that the use of the relational definite DP the colour cannot be accommodated.

To conclude so far, in corrections with VP focus containing a definite DO that DO must leave the c-command domain of the negation in the first conjunct if the second conjunct is still about the referent of that DO. There need not be an overt expression corresponding to that referent, i.e. it can remain implicit.³ In the next section I shall investigate the nature of the implicit referent in the second conjunct.

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³ As the wording suggests the implicit topic in the second conjunct can be made explicit. This holds for all the examples discussed in this paper. If explicit, the chosen form is usually a pronoun, which, interestingly, need not occur outside the vP of the second conjunct. Fanselow (2006) suggests that topics do not obligatory move to the topic position suggested by Frey (2004) but that there is an interaction
3 The implicit referent in the second conjunct

The implicit referent in the second conjunct is interesting from (at least) two points of view. On the one hand, we need to ask what grammatical status that referent might have. This is discussed in section 3.1 and will be specified in more detail in section 4. I shall argue that the implicit referent is an implicit argument or, an unarticulated constituent, which is anaphoric to an antecedent in the context. In section 3.2 I shall demonstrate that topics – such as the one in the first conjunct – are very good antecedents to be picked up by anaphora.

3.1 Implicit arguments and unarticulated constituents

The examples we have seen all look like they involve what has been called an implicit argument. An implicit argument is a non-overt element that is part of the interpretation of a predicate and is usually thought to occur in positions which are licensed for a thematic argument, which, however, are not overtly realized (cf. Williams 1985, Roeper 1987, Engelberg 2002). For the examples discussed above, this reads as given in very rough form in (13), where the implicit argument occurs between brackets:

(13) a. to enquire at the garage (about x) 
b. the colour (of x)

Implicit arguments can receive different interpretations (see e.g. Bhatt & Pancheva 2006). They can be interpreted as existential as in Paul is eating (something), generic as in (PRO) to dance is fun, or definite and contextually determined as in John finally accepted (x). The definite, contextually determined cases are the ones that resemble the correction data most closely. (Some) implicit arguments can pick up previously introduced antecedents (cf. Härtl 2008) as in John got the boxes and stuck the labels on, where the labels in all likelihood are stuck on the boxes, or as in Paul bought the best-seller and read all night, where Paul in all likelihood read the best-seller (but also see Martí 2006 on this). I shall not dwell here on the question of how particular types of implicit arguments are analyzed. The reason is that the argument structure in the second conjunct upon closer scrutiny turns out to be not that important, as example (14a) from an online lexicon on media law illustrates: there is no implicit argument of the sort described above involved but still the second conjunct contains an implicit referent picking up the topic (=DO) of the first conjunct: the authorities use other sources of the journalist's than his/her 'voice', i.e. the second conjunct still is about the journalist. (14) is also different from the previous examples in that the order of the negation and the DO is flexible. In (14b), the negation precedes the DO of the focused VP. The example

with foci occurring below the sentential adverb. I think that Fanselow's observations are correct but I cannot investigate this matter here for reasons of space.

4 The various sorts differ substantially, see Bhatt & Pancheva (2006), Härtl (2008).
also is fine. Importantly, there is a difference in interpretation between (a) and (b). In (b), the authorities use other sources than the interrogation of the journalist, i.e. the journalist is not topical in the second conjunct.

(14)  Confiscation of means of evidence. § 97 Abs. 5 StPO prohibits the confiscation of journalistic documents as means of evidence. This holds only, however, to the same extent that the media person has the right to refuse to give evidence. The prohibition of the confiscation of means of evidence is a necessary addition to the media’s right to refuse to give evidence. [If it didn’t exist the investigating authorities could very easily circumvent the right to refuse to give evidence,...] [Existierte es nicht, könnten die Ermittlungsbehörden es leicht aushebeln, …] 

a. indem sie den Journalisten nicht befragen,…
   by they the journalist not interrogate

b. indem sie nicht den Journalisten befragen,…
   ...sondern gleich die Durchsuchung der Redaktionsräume und die Beschlagnahme des Recherchematerials anordnen.
   '...by not interrogating the journalist, but ordering the search of the editorial offices and the confiscation of research material straightaway.'

I would like to argue that the second conjunct in (14a) contains what in truth-conditional pragmatics has been called an unarticulated constituent (UC) (Perry 1986, 1998; Recanati 2002, 2004; and for an opposing view Stanley 2000, Marti 2006). As summarized by Stanley (2000: 410), unarticulated constituents are elements "supplied by the context to the truth conditions of utterances" without being the "semantic values of any constituents in the actual structure of natural language sentences". To illustrate, consider Perry's (1986) example in (15):

(15)  It is raining.

(15) is incomplete if no place is supplied, and cannot be evaluated for truth or falsity, i.e. failure to provide the UC results in vacuity. No proposition is expressed. The idea in truth-conditional pragmatics is that there is free pragmatic enrichment (top-down), which is necessary to interpret such sentences. Next to UCs supplied by the context, there are also 'metaphysical' UCs, as in Mary is dancing, where the place where Mary is dancing, is not required to express a proposition and assess its truth. The fact that Mary is dancing somewhere is a metaphysical fact, i.e. one of the real world: every action takes place somewhere (or at some time …). The views on metaphysical UCs differ but the assumption that they are 'truly' unarticulated is common – i.e. they are not part of the interpretation. If interpreted at all, they are a matter of pragmatics. Their interpretation is existential.

Going back to (14a), we find that the second conjunct contains an implicit referent that could be classified as a metaphysical UC if it were not provided contextually: that there is a relation between the journalist and his various potential sources of evi
dence, which might be interesting to the authorities, is a metaphysical fact. That we infer this information to be present in (14a) – it is the journalist’s editorial offices whose search is ordered and *his/her* research material that is to be confiscated – shows that UCs which are not required to express a proposition can be present in the interpretation of a sentence if they are provided contextually. Importantly, their presence has an effect on grammar – the DO in the first conjunct of the correction takes a different position if the UC is present: it occurs above the negation because it is a topic and serves as the contextual antecedent of the UC. This supports opponents of the free enrichment view (e.g. Stanley 2000, Martí 2006), who claim that there are no unarticulated constituents of the contextual sort. The referents in question are articulated (at LF): as variables that need to be contextually resolved. Also note in this connection the felicity of the order negation > DO in (14b): in this order, there is no contextual UC, it stays metaphysical, as it were.

In the present analysis, I shall lump implicit arguments and unarticulated arguments together, see section 4 for the specific proposal. Nevertheless, I suspect that there might be a difference between the two types of implicit referents because the case with the unarticulated constituent allows both orders of DO and negation, whereas the cases with implicit arguments do not.

3.2 An antecedent for the implicit referent

In the previous subsection I suggested that the value for the implicit referent in the second conjunct is provided by the context and that it is the topical DO in the first conjunct that serves as the antecedent. Frey (2007) discusses the relation between topichood and anaphoric reference and points out that it is standardly assumed that anaphoric expressions like pronouns refer to previously introduced referents that are salient (e.g. Ariel 1990; Gundel et al. 1993). Being a topic is one way to be salient (e.g. Gundel et al 1993; Erteschik-Shir 1997). Frey (2007: 12) disputes this traditional assumption on the basis of the following minimal pair – the judgement is Frey's:

(16) a. Gestern hat überraschen- [den Paul] [der Direktor] getroffen. derweise
     yesterday has surprisingly the.ACC Paul the.NOM director met
a&b. Er has very about.it happy
     he

"Yesterday the director surprisingly met Paul. He was very happy about it."

In (16a), the DO in the first sentence is non-topical, whereas in (16b) it is topical. Frey says that the anaphoric possibilities in (a) and (b) are the same, i.e. there is a subject preference. My intuitions and those of a fair number of informants I consulted about (16) are different: Whereas in (16a), the indexation is as indicated, in (16b), the pronoun he refers to Paul, and not the director. I suggest that the judgements are subtle because the topic 'competes' with the subject as a potential antecedent: there is a strong
subject reference for pronoun resolution in general, as has been shown in experimental studies by e.g. Crawley & Stevenson (1990), Stevenson & Urbanowicz (1995). Kaiser (2006) found that subject preference is influenced by, but still overrules factors like preference for focus and topicality (which is implemented as givenness in her, and many other psycholinguistic studies\(^5\)). Kaiser (2006) concludes that topicality does have an effect on pronoun resolution (also Arnold 1998) but interacts with other factors.

Apart from the sentence medial topics, Frey (2007) discusses data with left dislocation in German, where, in his view, a dislocated topical direct object does not serve as an antecedent for a pronoun in the next clause if a subject is present that can serve as an antecedent for that pronoun. I think that this does not hold generally. In the following example it is completely unclear whether the DO or the subject is the antecedent for the pronoun in the follow-up clause, as is illustrated by the two options, (a) and (b), to continue the discourse.

(17)  Max cannot see his friends tonight.
[Den Paul], den hat [der Hausmeister] eingespannt.
the ACC Paul him has janitor monopolized
Er\(_{1/2}\) baut das Schuhregal für die ersten Klassen.  
he builds the shoe.shelves for the first grades
'As for Paul, the janitor is monopolizing him. He is building the shoe shelves for the first graders.'

a. Paul hilft ihm\(_{2}\) dabei.  
Paul helps him with.this
'Paul is helping him.'

b. Das hat er\(_1\) dem Hausmeister vorigen Monat versprochen.  
that has he the janitor last month promised
'That's what he promised the janitor last month.'

Thus, topics can and do compete with subjects for the role of most salient antecedent. In harmony with much of previous psycholinguistic literature I assume topics to be good antecedents. In the corrections, the scrambled DO in the first conjunct is a topic, which serves as the antecedent for the implicit referent in the second conjunct.

### 4 The (information) structure of corrections with VP focus

In the previous sections I argued that in corrections with VP focus containing a definite DO in the first conjunct, that object must precede the negation if it is topical itself and if the second conjunct still is about that topic, even though the topic in the second conjunct is implicit. I suggest that this implicit topic is represented syntactically by a topic-marked pro, where the topic feature has the following denotation:

\(^5\) Many psycholinguistic studies work with the notion of 'active discourse referents', where givenness is one indicator for being active.
Thus, it is presupposed that x is a salient individual in the context,\(^6\) and it is asserted that the predicate \(P\) applies to that individual. The [TOP] feature occurs on an entity-denoting constituent, which in the present case is the implicit argument in the second conjunct. The denotation of a topic-marked constituent \(\alpha_{\text{TOP}}\) is given in (19)\(^7\):

\[
\begin{align*}
\llbracket \alpha_{\text{TOP}} \rrbracket &= \llbracket \text{TOP} \rrbracket (\llbracket \alpha \rrbracket) \\
&= \lambda P \[ \exists i.g(i) = \llbracket \alpha \rrbracket : P(\llbracket \alpha \rrbracket) \rrbracket
\end{align*}
\]

In (6), which is repeated below without its context, the individual in question is the topic of the corrected clause (see (20) for the precise structure).

\[
\begin{align*}
\text{(6')} \quad \text{Am Ende hat er [das Auto \text{TOP}] nicht [\text{VP verkauft} \text{FOC}] at.the.end has he \text{the} \text{car} \text{not sold} \\
&\text{sondern sich pro_{\text{TOP}} [\text{VP bei seiner Werkstatt erkundigt} \text{FOC}] but \text{REFL} \text{at his} \text{garage} \text{enquired}}
\end{align*}
\]

'I in the end he didn’t sell the car but enquired at his garage.'

In the order where the negation c-commands the direct object, viz. (5), the context does not provide such an individual. If \(\text{pro_{\text{TOP}}}\) occurs in the structure, presupposition failure ensues.

It is worth pointing out that the structure of (6) corresponds to Vallduvi’s (1993) tripartite information structure setup: in addition to the topic (= Vallduvi’s link) and focus, there is material that can be classified as the ground: \(\text{am Ende hat er} \) (‘in the end he has’). I assume that whereas the implicit topic in the second conjunct is retrieved on the basis of \(\text{pro_{\text{TOP}}}\) introduced above, the ground is retrieved on the basis of ellipsis processes. The ellipsis process in question is left peripheral deletion, which happens under phonological identity with material in the first conjunct (cf. Wesche 1995; Repp 2009). The analysis for (6) is given in (20). The ellipsis site in the second conjunct is indicated by strikethrough. The position of \(\text{pro_{\text{TOP}}}\) is above IP, which corresponds to Frey’s (2004) topic position. As for the structure of the correction itself, I follow the assumption in McCawley (1991) and Lang (1991) that \textit{not-but} is a complex operator. I propose that its parts NEG and CORR are licensed by Agree with a coordination head that is marked as corrective, and which hosts \textit{sondern}.\(^8\)

---

\(^6\) I am borrowing here from Sauerland (2004) who suggests that an individual is given if it is the value of some index of the assignment \(g\), where only individuals that are salient are stored in \(g\).

\(^7\) I am abstracting away from indefinite topics (Endriss 2006) here as they are not relevant in the present discussion.

\(^8\) For reasons of space I could not discuss pronouns here, which behave different from definite DOs in corrections: they are never c-commanded by the negation even if they are not picked up by a topical referent in the second conjunct. The behaviour of pronouns in corrections parallels that of pronouns in other environments, e.g. DP scrambling has an information-structural effect on the next lower DP (provided the scrambled DP is not contrastive), pronoun movement does not. Thus, the high position of
(20) Analysis for (6):

5 Conclusion

I have argued that despite first appearances in corrections with VP focus, the negation in the first conjunct c-commands the focus just as in corrections with narrow(er DP) focus. If, however, the DO in such a VP is topical and is picked up by a(n implicit) topic in the second conjunct, the DO leaves the c-command domain of the negation. The implicit topic in the second conjunct structurally is represented as a pro element with a topic feature.

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pronouns in the middle field is licensed by givenness alone and does not necessarily interact with other information-structural categories.
References


Free Variable Economy

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Abstract
Several authors have recently argued that semantic interpretation is subject to economy constraints. In particular, Fox (1999) argued that the interpretation of pronouns is subject to BINDING ECONOMY, which favors local binding over non-local binding. The present paper points out a problem for BINDING ECONOMY. The aim, then, is to see if this problem can be resolved in a conservative way, that is, preserving the general idea that interpretation is subject to economy constraints. The suggested solution is to consider a different economy criterion. The proposed constraint, FREE VARIABLE ECONOMY, disfavors free variables rather than non-local binding. It avoids the problem that BINDING ECONOMY runs into, and preserves the general idea that semantic interpretation is subject to economy constraints.

1 Economy and Semantic Interpretation
Several authors have recently argued that semantic interpretation is subject to economy constraints (cf. Fox, 1999; Reinhart, 2006). The general idea is that one logical form is ungrammatical if there is an alternative logical form which is:
1. semantically equivalent
2. syntactically simpler / more economical
To make this general idea more precise, we have to answer two questions:
1. When are two logical forms semantically equivalent?
2. When is one logical form simpler / more economical than another?
In this paper, I will focus on the second question. More particularly, I will be concerned with a measure of economy, proposed by Fox (1999), which says that logical forms in which pronouns are bound locally are more economical than logical forms in which pronouns are bound non-locally. Fox has shown that the associated economy constraint, which I will refer to as BINDING ECONOMY, accounts for a range of interesting data. Most strikingly, it deals with a long-standing problem in the theory of VP-ellipsis, known as Dahl’s puzzle (Dahl, 1973).
However, I will point out below that a variant of Dahl’s puzzle is problematic for BINDING ECONOMY. My aim, then, is to resolve this problem in a conservative way. That is, I will try to preserve the general idea that semantic interpretation is subject to economy constraints, as well as the basic assumptions about the syntax-semantics interface and the nature of pronominal anaphora that proponents of this idea generally presuppose. My strategy will be to reconsider the question when a certain logical form should count as more economical than another. Fox’s measure of economy is concerned with locality of pronominal binding. The measure of economy that I will propose is concerned with free variables. The associated economy constraint, FREE VARIABLE ECONOMY, disfavors free variables rather than non-local binding. This will be shown to resolve the problem that BINDING ECONOMY runs into.

The paper is organized as follows. First, some theoretical assumptions, terminology, and notation will be fixed in section 2. BINDING ECONOMY will be presented in section 3, followed by the new problematic data in section 4. Finally, FREE VARIABLE ECONOMY will be presented in section 5, and section 6 concludes.

2 Preliminaries

Let me start by fixing some theoretical assumptions, terminology and notation.

Syntax-semantics interface. I will assume that syntax generates logical forms (LFs), and that these logical forms are associated with a certain semantic meaning (or with an expression in the typed lambda-calculus representing such a meaning) in a compositional fashion, along the lines of Heim and Kratzer (1998).

Bound and referential pronouns. I will assume a basic distinction between bound and referential pronouns (cf. Reinhart, 1983). Pronouns may or may not be indexed at LF. A pronoun with an index \( n \) is interpreted as a variable \( x_n \) (the index is called a binding index in this case). If a pronoun is not indexed, it is taken to refer to some contextually salient individual.

Movement and abstraction. I will assume that wh-movement and quantifier raising work as follows. If a wh-element moves it receives a binder index \( n \), which is adjoined to it in superscript (e.g., \([\text{who}]^{3}\)). It also leaves behind a trace which has that same index \( n \) as its binding index (e.g., the trace of \([\text{who}]^{3}\) would be \( t_3 \)).

\[
(1) \quad [\text{TP} \ X \ [\text{DP} \ \text{wh}] \ Y] \Rightarrow [\text{TP} \ [\text{DP} \ \text{wh}]^n \ [\text{TP} \ X \ t_n \ Y]] \quad \text{(wh-movement)}
\]

The same goes for quantifier raising: if a determiner phrase undergoes QR it receives a binder index \( n \) and leaves behind a trace which has that same index \( n \) as its binding index.

\[
(2) \quad [\text{TP} \ X \ [\text{DP} \ \text{Q}] \ Y] \Rightarrow [\text{TP} \ [\text{DP} \ \text{Q}]^n \ [\text{TP} \ X \ t_n \ Y]] \quad \text{(quantifier raising)}
\]
I will assume that determiner phrases always undergo QR. This assumption will make some of the formulations below run smoother, but nothing hinges on it.

A trace with a binding index \( n \) is interpreted as a variable \( x_n \), and a constituent of the form \( X^n Y \) is interpreted as:

\[
X'(\lambda x_n. Y')
\]

where \( X' \) is the interpretation of \( X \) and \( Y' \) is the interpretation of \( Y \). This composition rule embodies what Heim and Kratzer (1998) call *predicate abstraction*. As a result, the logical form in (4) is interpreted as (5):

\[
\begin{align*}
(4) & \quad \text{[John][t\_1 called his\_1 mother]} \\
(5) & \quad \text{JOHN}(\lambda x_1. x_1 \text{ CALLED } x_1 \text{'s MOTHER})
\end{align*}
\]

**Binding and reference.** To define binding we first have to specify one auxiliary notion, namely that of *c-command* (cf. Reinhart, 1983). One constituent \( A \) c-commands another constituent \( B \) iff (i) \( A \) does not dominate \( B \) and (ii) all branching nodes that dominate \( A \) also dominate \( B \).

Now let \( A \) be a determiner phrase with a binder index, and let \( B \) be a pronoun with a binding index. Then we say that \( A \) binds \( B \) iff:

(i) \( A \)'s binder index matches \( B \)'s binding index,

(ii) \( A \) c-commands \( B \), and

(iii) \( A \) does not c-command any other DP which satisfies (i) and (ii).

This notion of binding is what Heim and Kratzer (1998) and Büring (2005b) call *semantic binding* and what Reinhart (2006) calls *A-binding*. To see what it amounts to consider example (4) above: according to the definition, [John] binds [his] in this logical form. To enhance readability, I will often use the following graphical notation:

\[
\begin{align*}
(6) & \quad \text{John called his mother.} \\
& \quad \text{[-------------]} \\
\end{align*}
\]

Think of (6) as shorthand for (4): the arrow indicates that [his] is bound by [John].

For referential pronouns I will also use a graphical notation. For instance, if [his] is taken to refer to John, I will write:

\[
\begin{align*}
(7) & \quad \text{John called his mother.} \\
& \quad \text{[ ]} \\
& \quad \text{John}
\end{align*}
\]

**VP ellipsis.** The literature is very much divided on the nature of VP ellipsis (cf. Johnson 2008 for discussion). I will assume that the meaning of an elided VP is contextually retrieved, typically from an overt VP in the surrounding discourse (cf. Hardt, 1993; Kehler, 2002; Roelofsen, 2008), but I should emphasize that, as far as I can see, the discussion below does not hinge on this assumption.
The graphical notation introduced above will be useful in depicting the possible interpretations of elided VPs. Consider example (8):

(8) Max called his mother and Bob did too.

This sentence is ambiguous. It could be taken to mean that Max and Bob both called Max’s mother. This is called the *strict* reading. But it could also be taken to mean that Max and Bob both called *their own* mother. This is called the *sloppy* reading. I assume that the strict reading arises if the pronoun in the source clause (the clause containing the antecedent VP) is taken to refer to Max. In this case, the pronoun in the target clause (the clause containing the elided VP) will also be taken to refer to Max (the “reconstructed” VP is printed in gray):

(9) Max called his mother and Bob called his mother too.

The sloppy reading arises when the pronoun in the source clause is *bound*. In this case, the pronoun in the target clause will also be bound. Only, in the source clause it is bound by [Max], while in the target clause it is bound by [Bob]:

(10) Max called his mother and Bob called his mother too.

I think it will be helpful to think of sloppy readings graphically: they arise when pronouns are, as it were, “bound in parallel” (cf. Fox, 1999; Büring, 2005a).

3 Binding Economy

We are now ready to have a closer look at Binding Economy. The idea is perhaps best illustrated by means of an example. Consider the following two logical forms:

(11) Max said that he called his mother.

(12) Max said that he called his mother.

These logical forms are semantically equivalent: they are associated with exactly the same semantic meaning. The difference is that in (11), the second pronoun, [his], is bound *locally*, by [he], while in (12) it is bound non-locally by [Max]. The idea behind Binding Economy is that logical forms like (12) are ungrammatical because of the existence of more economical logical forms like (11). To give a general and precise formulation of Binding Economy, we first have to specify which kind of structures it considers to be *alternatives*.
Alternatives. Two LF constituents are alternatives iff they are (i) semantically equivalent, and (ii) formally identical modulo binding indices on pronouns.

Next, we must specify what it means for one alternative to be more economical than another.

Economy Measure. Suppose that $\Sigma$ and $\Pi$ are alternatives. Then we say that $\Pi$ is more economical than $\Sigma$ if and only if there is a pronoun $P$ and determiner phrases $A$ and $B$ in $\Sigma$ and $\Pi$ such that:

1. $A$ binds $P$ in $\Sigma$;
2. $B$ binds $P$ in $\Pi$;
3. $A$ c-commands $B$ in $\Sigma$ and $\Pi$.

Now we are ready to state Binding Economy.

Binding Economy.
An LF constituent is ruled out if it has a more economical alternative.

Empirical evidence for this constraint mainly comes from a notorious puzzle concerning VP ellipsis, dating back to (Dahl, 1973). Consider the following sentence:

(13) Max said that he called his mother and Bob did too.

Notice that the second conjunct contains an elided VP, and that the overt VP in the first conjunct contains two pronouns. We may expect, then, that this sentence has at least four readings: one in which both pronouns are interpreted strictly, one in which they are both interpreted sloppily, and two “mixed” readings where one of the pronouns is interpreted strictly and the other sloppily. Surprisingly, one of these mixed readings is not available (in neutral contexts):

(13) Max said that he called his mother and Bob did too.
   a. . . . Bob too said that Max called Max’s mother. [strict-strict]
   b. . . . Bob too said that Bob called Bob’s mother. [sloppy-sloppy]
   c. . . . Bob too said that Bob called Max’s mother. [sloppy-strict]
   d. #. . . Bob too said that Max called Bob’s mother. [strict-sloppy]

Thus, the challenge is to account for the fact that (13-a), (13-b), and (13-c) are possible readings of the target clause in (13), while (13-d) is not.

Binding Economy accounts for this fact. To see this, first consider the strict-sloppy reading in (13-d). This reading corresponds to the following LF:

(14) Max said he called his mother and Bob said he called his mother too.
Consider the first conjunct of this logical form:

\[(15) \quad \text{Max said he called his mother.}\]

This constituent has a more economical alternative:

\[(16) \quad \text{Max said he called his mother.}\]

As a consequence, **BINDING ECONOMY** rules out (15), and therefore also (14). Thus, (13-d) cannot be derived as a reading for (13), as desired. The other three readings, (13-a), (13-b), and (13-c), *can* be derived, through the following three logical forms. None of these involves non-local binding.

\[(17) \quad \text{Max said he called his mother and Bob said he called his mother too.}\]

\[(18) \quad \text{Max said he called his mother and Bob said he called his mother too.}\]

\[(19) \quad \text{Max said he called his mother and Bob said he called his mother too.}\]

4 **Problem for Binding Economy**

Consider the following sentence:

\[(20) \quad \text{No student said he liked his paper, but every student thought the teacher would.}\]

This sentence has the following *strict* reading (among others):

\[(21) \quad \ldots \text{every student} x \text{ thought the teacher would like} x^{'}s \text{ paper.}\]

**BINDING ECONOMY** wrongly blocks this reading. To see this, consider the corresponding logical from:

\[(22) \quad \text{NoS said he liked his paper, but everyS thought T would like his paper.}\]

The first conjunct has a more economical alternative:
Thus, BINDING ECONOMY rules out (22). Notice that example (20) is very similar to Dahl’s original example. If we strip off the second conjuncts, we are left with:

(24) Max said he called his mother.
(25) NoS said he liked his paper.

The only relevant difference is that the subject of (24) is a referential determiner phrase, whereas the subject of (25) is a quantifying determiner phrase. In both cases, BINDING ECONOMY predicts that non-local binding of [his] is ungrammatical. Graphically:

(24) \[
\begin{array}{c}
\text{Max} \\
\text{Max said he called his mother.}
\end{array}
\]

(25) \[
\begin{array}{c}
\text{NoS} \\
\text{NoS said he liked his paper.}
\end{array}
\]

In the case of (24) this is a welcome prediction, as it accounts for Dahl’s puzzle. But in the case of (25) it is not, because it blocks the strict reading of (20).

It is worth noting that this problem carries over to alternative accounts of Dahl’s puzzle such as those of Kehler (1993), Fiengo and May (1994), and Schlenker (2005).

5 Free Variable Economy

I will try to overcome this impasse in a way that preserves the general idea that semantic interpretation is subject to economy constraints. BINDING ECONOMY was derived from this general idea by assuming that one logical form is more economical than another if the pronominal binding relations it encodes are more local. This particular assumption seems to be problematic, but that does not mean that the general idea must be given up. There may be other measures of economy. Below, I will formulate such a measure. It is concerned with free variables, which are defined as follows:

**Free Variables.** Let \( \Sigma \) be an LF constituent, and let \( P \) be an indexed pronoun in \( \Sigma \) that is not bound within \( \Sigma \). Then the index on \( P \) is called a free variable in \( \Sigma \).

Let me give some examples (I must return here to using indices instead of arrows):

(26) a. \([\text{Max}]^2 [t_2 \text{ called his}_2 \text{ mother}]\]
    b. \([\text{Max}]^2 [t_2 \text{ called his}_1 \text{ mother}]\]
    c. \([\text{he}_1]^2 [t_2 \text{ called his}_1 \text{ mother}]\]
    d. \([\text{he}_1]^2 [t_2 \text{ called his}_2 \text{ mother}]\]
(26-a) does not contain any free variables, because the pronoun it contains is bound within the given constituent. (26-b) does contain a free variable, because the pronoun [his] has a binding index, and is not bound within the given constituent. (26-c) also contains one free variable. Notice that we are not counting occurrences of free variables. The constituent contains two unbound pronouns, but both have the same index, so there is only one free variable. If one of the pronouns is bound, as in (26-d), the number of free variables does not change, it is still one.

In terms of free variables, we can define the following economy measure:

**Economy Measure.** Suppose that $\Sigma$ and $\Pi$ are alternatives. Then we say that $\Pi$ is more economical that $\Sigma$ if and only if some sub-constituent $\Pi'$ of $\Pi$ contains fewer free variables than the corresponding sub-constituent $\Sigma'$ of $\Sigma$.

Now we are ready to state **Free Variable Economy**.

An LF constituent is ruled out if it has a more economical alternative.

Notice that the formulation of **Free Variable Economy** is identical to that of **Binding Economy**. The only thing that has changed is the measure of economy.

Free Variable Economy accounts for Dahl’s puzzle, and it does not rule out the strict reading of (20). In other words, it prohibits non-local binding in (24) but not in (25). To see this, first consider (24), repeated in (27) using index-notation:

(27) $[[Max]^1 [t_1 said that [he]^2 [t_2 called his_{1\,mother}]west]]$

This logical form has the following alternative:

(28) $[Max]_1 [t_1 said that [he]^2 [t_2 called his_{2\,mother}]west]

The only difference between (27) and (28) is that in (27), [his] is bound by [Max], while in (28), it is bound by [he]. The two logical forms are semantically equivalent, and, crucially, (28) is more economical than (27). To see this, consider the embedded clause. In (27), the embedded clause contains a free variable; in (28) it does not. This is enough for (28) to be considered more economical than (27), and thus for **Free Variable Economy** to account for Dahl’s puzzle.

Now consider (25), repeated in (29) using index-notation. Recall that this logical form should not be ruled out (otherwise the strict reading of (20) cannot be derived).

(29) $[[No\,student]^1 [t_1 said that [he]^1 [t_2 liked his_{1\,paper}]west]]$

This logical form has the following alternative:
(30) \[\text{[[No student]}^1 [t_1 \text{ said that } [\text{[he}]}^2 [t_2 \text{ liked his}_2 \text{ paper}]])\]

But this alternative is not more economical. Consider, in particular, the embedded clause. In (29), neither [he] nor [his] is bound within the embedded clause, but both carry the same index, so the embedded clause contains one free variable. In (30), [his] is bound within the embedded clause, but [he] is not, so the clause still contains one free variable. Thus, the embedded clause in (30) does not contain fewer free variables than the embedded clause in (29). It can be shown that no other constituent in (30) contains fewer free variables than the corresponding constituent in (29), and that the same holds for other alternatives of (29). Thus, FREE VARIABLE ECONOMY does not rule out (29) and correctly derives the strict reading of (20).

6 Conclusion

We have considered the idea that semantic interpretation is subject to economy constraints. We focused on one particular measure of economy, proposed by Fox (1999). This measure favors local pronominal binding over non-local binding. The resulting economy constraint, BINDING ECONOMY, accounts for a long-standing puzzle concerning VP ellipsis, dating back to Dahl (1973).

We have seen, however, that a variant of Dahl’s original puzzle is problematic for BINDING ECONOMY. In response to this, we have considered an alternative measure of economy. This measure disfavors free variables. The resulting economy constraint, FREE VARIABLE ECONOMY, accounts for Dahl’s original puzzle, and also for the variant that was shown to be problematic for BINDING ECONOMY.

The general strategy in this paper was to try and resolve the encountered problem in such a way that as much of the general theoretical assumptions that were taken as a starting point would be preserved (the idea that semantic interpretation is subject to economy constraints, but also even more basic assumptions about the syntax-semantics interface, the nature of pronominal anaphora and VP ellipsis, etcetera). Whether these assumptions are ultimately justifiable, is a different issue. In (Roelofsen, 2008), I argue against some of them and eventually present a different outlook, especially on the nature of pronominal anaphora and VP ellipsis. Of course, this also leads to a different account of the data discussed here. The outlines of such an account are sketched in (Roelofsen, 2008). Economy continues to play a role there, but not in the process of generating grammatical logical forms. Rather, it affects the process of anaphora resolution. I believe that this may ultimately be more realistic, but in order to uphold such a claim, many details still have to worked out. That’s for the future.

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References

Abstract
The purpose of this paper is to compare three existing theories of de re/de dicto ambiguity: (i) the scope theory, (ii) the intensional variable theory and (iii) the presupposition projection theory. We will conclude that the presupposition projection theory is the conceptually most desirable among these, although all three are expressive enough to describe the data. In particular, we will present novel data suggesting that the intensional variable theory is too expressive and hence lacks explanatory power.

1 Introduction

De re/de dicto ambiguity refers typically to the ambiguities in the interpretations of determiner phrases (DPs) in relation to modal operators. A representative example with a definite DP is given in (1).

(1) John thinks that the president of United States is smart.

Consider the situation as of today, in which Barack Obama is the president of United States and suppose that John wrongly thinks that Al Gore is. In this context, the sentence has two interpretations. It can be read as reporting John’s belief about Barack Obama or about Al Gore. The former is called the de re reading and the latter the de dicto reading. Similarly, indefinites show the same kind of ambiguity as illustrated in (2).

(2) Sue wants to marry a plumber.
In the *de re* reading, the sentence is about an actual plumber who Sue wants to marry, and crucially, she does not have to know that he is a plumber. The *de dicto* reading, on the other hand, means that Sue wants to marry someone she thinks is a plumber.

In this paper, we only deal with one side of this phenomenon. That is, we are concerned with how the *de re* and *de dicto* readings are disambiguated at the relevant grammatical representation, and not with how they—especially *de re* readings—are adequately represented in a formal metalanguage (for this topic, see Cresswell and von Stechow 1982; Kaplan 1969; Lewis 1979; Maier 2006; Quine 1956 among others). The objective of this paper is to compare three theories of *de re/de dicto* ambiguity found in the literature, namely (i) the scope theory, (ii) the intensional variable theory and (iii) the presupposition projection theory. We will conclude that the presupposition projection theory is conceptually the best among these. In the following three sections, we will examine them in detail in this order. Section 5 briefly discusses the consequences of our conclusion with regards to the theory of presupposition projection.

# 2 The Scope Theory

The classic way to capture *de re/de dicto* ambiguity is to analyze it as a scope phenomenon between DPs and modal operators (Cresswell and von Stechow 1982; Fodor 1970; Keshet 2008; Montague 1973; Partee 1974; Russell 1905 among others). Under this theory, the readings of (1) and (2) are paraphrased as follows.

(3) John thinks that the president is smart.
   a. The president *x* is such that John believes *x* is smart.
   b. John believes that the president *x* is such that *x* is smart.

(4) Mary wants to marry a plumber.
   a. There is a plumber *x* and Mary wants to marry *x*.
   b. Mary believes there is a plumber *x* and wants to marry *x*.

However, Bäuerle (1983), Fodor (1970, §4.3) and Percus (2000) point out that the naive scope theory is too weak and runs into the problem of scope puzzle.

To state the conclusion first, the scope puzzle suggests the need for differentiating the mechanisms of scope taking and the interpretation of the restrictor of the DP in question, which is impossible in a naive scope theory. Thus, more fine-grained terminologies than the simple dichotomy of *de re* an *de dicto* are needed, and we will henceforth use the following (cf. Bonomi, 1995; Quine, 1956).

(5) a. **Wide/Narrow Scope:**
   The quantifier scope with respect to the intensional operator
b. **Transparent/Opaque:**
   Whether the extension of a predicate is actual or not

---

1The fact that the operator that the existential quantifier gets caught in is an epistemic operator rather than a bouletic one needs an explanation in any theory. See Heim (1992) and Geurts (1998) for discussions.
The *de re* readings of the previous examples as described above are wide scope transparent, while the *de dicto* readings are narrow scope opaque. The gist of the scope puzzle is that narrow scope transparent readings also exist.\(^2\)

### 2.1 Scope Puzzle

Now let us look at concrete examples. Fodor (1970) uses the following example.

(6) Charley wants to buy a coat like Bill’s.

(Fodor, 1970, 226)

The wide scope transparent and narrow scope opaque readings are not surprising and, in the scope theory, they can be informally paraphrased as follows.

(7) a. There is a coat like Bill’s \(x\) such that Charley wants to buy \(x\).

b. Charley believes that there is a coat like Bill’s \(x\) and wants to buy \(x\).

Fodor points out that there is yet another reading, which is true in the following kind of context: suppose that a store sells some coats that all look like Bill’s, and that Charley does not know anything about Bill. Assume further that Charley wants one of those coats and any of them is an option. The sentence in (6) is true in this context, but neither of (7) represents this reading. In fact, there is no other scope possibility for the DP in question.

The scope puzzle is not confined to indefinites, and applies to strong quantifiers, as the following example illustrates (cf. Percus, 2000).

(8) If every man was a woman, John would be happy.

The most salient reading of this sentence is that if every actual man was a woman, John would be happy. The logic of the problem is exactly the same as above. In a naive scope approach, if *every man* is read transparent, it has to take wide scope, and if it is read opaque, it has to take narrow scope, but neither of them is the desired reading. Rather, what we want here is to interpret the restriction as being outside of the antecedent of the conditional, while the scope as being inside.

### 2.2 Semantic Reconstruction as a Solution

Before leaving this section, we present one possible way of saving the scope theory from the scope puzzle (see Keshet, 2008 for a different proposal). Specifically, assuming quantifying-in as the mechanism of scope taking, higher order abstraction (or semantic reconstruction) can be used to solve the puzzle (von Fintel and Heim 2007; for semantic reconstruction in general, see Cresti 1995; Heim and Kratzer 1998; Sternefeld 2001). In this way, scope taking and transparency can be treated in some sense separately: quantifying-in dealing with the former and semantic reconstruction dealing with the latter. The problematic readings of the sentences above can be represented as follows, for example.

---

\(^2\)Wide scope and opaque readings are logically possible, but whether they exist as semantically distinct readings in natural language is controversial (Fodor, 1970; Bonomi, 1995; Keshet, 2008). To simplify the discussion, we will put them aside in this paper.
(9)  

\begin{itemize}
  \item a. [a coat like Bill’s] $\lambda Q_{(r,t)}$ Charley wants to buy $Q$
  \item b. [every man] $\lambda Q_{(r,t)}$ if $Q$ was a woman, John would be happy
\end{itemize}

Here, the DPs are interpreted above the intensional operators and thus they are transparent, but the scope is reconstructed below the operators. This solution requires a treatment for non-subject quantifiers, but such methods have been explored in the literature, for example, type-shifting (Sternefeld, 2001) and intermediate semantic reconstruction (Cresti, 1995).

However, there is a conceptual criticism that one can raise against this solution. It is known that quantificational DPs generally cannot take scope out of a tensed clause, but sentences like (8) require exactly this. It is of course possible to modify the locality constraint so that it is not a restriction on quantifying-in in general, but only on first-order quantifying-in. However, such an ad hoc formulation is conceptually undesirable.

### 3 The Intensional Variable Theory

The intensional variable theory separates the scope and the transparency mechanisms more directly by positing intensional variables in the object language so that transparency is treated by logical binding of intensional variables, while the scope is dealt with by an independent scope taking mechanism (von Fintel and Heim, 2007; Keshet, 2008; Musan, 1995; Percus, 2000). For example, the ambiguity in our initial example is described as follows, where $s$ and $s'$ are variables ranging over situations.

(10)  

\begin{itemize}
  \item a. John thinks that the president is smart.
  \item b. John thinks $[\lambda s' \text{ the president-}s \text{ is smart }]$ (transparent)
\end{itemize}

By employing a completely distinct mechanism for dealing with transparency, this theory is free from the scope puzzle and does not involve any extra assumption about the locality of scope. In fact, the narrow scope transparent readings of the problematic sentences above are easily described as follows:

(11)  

\begin{itemize}
  \item a. Charley wants $[\lambda s' \text{ to buy a coat-like-Bill's-}s]$  
  \item b. If $[\lambda s' \text{ every man-}s \text{ was a woman }]$, John would be happy.
\end{itemize}

However, as Percus (2000) and Keshet (2008) point out, this theory is too strong in its expressive power and generates impossible readings. They propose four constraints to prohibit such impossible readings, which we now review. We also show the need for an additional, novel constraint.
3.1 Overgeneration and the Four Constraints

3.1.1 Main Predicate and Adverb Constraints

As Percus (2000) points out, main predicates and adverbs cannot have transparent readings. Thus, the following (a) examples do not have the readings paraphrased by the (b) sentences.³

(12) a. Mary thinks that my brother is Canadian.
   b. The set of Canadian X is such that Mary thinks that whoever she thinks is my brother is a member of X.

(13) a. Mary thinks that my brother always won the game.
   b. All the relevant rounds R of the game is such that Mary thinks that whoever she thinks is my brother is the winner in R.

These readings are readily generated in the intensional variable theory by indexing the intensional variable on the main predicate and the adverb with the respective evaluation index. Percus (2000) proposes the following constraints to block them.⁴

(14) a. **Main Predicate Constraint**
    Main predicates cannot be interpreted transparent.
   b. **Adverb Constraint**
    Adverbs cannot be interpreted transparent.

3.1.2 Intersective Predicate Constraint

Keshet (2008) further points out that intersective modifiers of a DP restrictor have to agree in transparency with the head NP. For example, the following example does not have a coherent reading, which would be possible if married and bachelor could have different intensional variables on them.

(15) #Mary thinks that the married bachelor is confused. (Keshet, 2008, 53)

This is not blocked by the Main Predicate or Adverb Constraints, and Keshet posits a third constraint:

(16) **Intersective Predicate Constraint**
    All intersective modifiers of a DP must agree in transparency with the NP.

3.1.3 Presuppositional DP Constraint

Thirdly, Keshet (2008) observes that non-presuppositional/cardinal DPs cannot be interpreted transparent (also Musan, 1995). The following example illustrates this.

³Percus’ original paraphrases for the (b) examples are not the readings we are after, and they are changed appropriately here.
⁴Percus calls them Generalizations X and Y, but we will use more transparent labels here. Similarly for the Intersective Predicate Constraint immediately below, which Keshet (2008) calls Generalization Z.
(17) [Context: There are two horses, but Charley thinks that they are donkeys.]
#Charley thinks that there are two horses.

This is not subsumed by the above constraints, and a new constraint is needed:

(18) **Presuppositional DP Constraint**
Only presuppositional DPs can receive transparent readings.

### 3.2 Nested DP Constraint

Lastly, we add one more constraint on the distribution of intensional variables, in order to account for the range of interpretations in a configuration where one DP is nested inside another DP.

(19) **Nested DP Constraint** (to be revised)
When a DP is embedded inside a DP, the embedding DP must be opaque if the embedded DP is opaque.

In such a nested context, there are four logically possible combinations of transparent/opaque, but one is systematically excluded. Specifically, if the embedded DP is opaque, the entire DP cannot be transparent.

Here is a concrete example. Putting aside the two uncontroversial interpretations where the two DPs agree in transparency, let us first consider the actually available mixed interpretation of (20-a) represented as (20-b).

(20) a. Mary thinks the wife of the president is nice.
   b. Mary thinks $\lambda s' \text{the wife-}s' \text{of the president-}s$ is nice

This is true in the following context: Mary is watching television and sees Barack Obama, the actual president, and his sister besides him. Also, she doesn’t know who he is and she thinks that the woman besides him must be is his wife. That (20-a) is true in this scenario means that (20-b) is a legitimate representation. The following is a more perspicuous example, where only the opaque-transparent reading is pragmatically felicitous.

(21) a. Mary wants to find every solution to the unsolvable problem.
   b. Mary wants $\lambda s' \text{to find [every solution-}s' \text{to [the unsolvable prob-}s]$]

On the other hand, as our generalization states, the reading in which the *president* is opaque and the *wife* is transparent is not available for (20-a). This should be true in the following context. Mary sees Bono Vox on TV with his wife Alison Hewson. Mary wrongly believes that he is the president, and furthermore, that the nice woman next to him is his sister. Thus, the wife-relation is actually true, but the characterization of Bono Vox as the president is not. Under the intensional variable theory, this reading can be represented as follows.

(22) Mary thinks $\lambda s' \text{the wife-}s \text{of the president-}s'$ is nice]
However, the sentence is not judged true in this context. Thus, our constraint is indepen-
dently necessary to prohibit the representation in (22).

Incidentally, the constraint is general enough to capture cases involving relative
clauses such as the following example, where only the transparent-opaque reading is
pragmatically felicitous on the assumption that unicorns do not exist in reality. The
infelicity of the example suggests this reading is again unavailable.

(23) a. #Mary thinks that [the man who likes the unicorn] is a woman.
b. Mary thinks [\(\lambda s'\) the man-\(s\) who likes the unicorn-\(s'\)] is a woman-\(s'\)]

We have so far seen cases with two definites. The situation is the same for strong quanti-
fiers, and we will not provide examples here for the sake of space. However, indefinites
are a bit more complicated, because they can take exceptional wide scope and each in-
definite is therefore three-way ambiguous: wide scope transparent, narrow scope opaque
and narrow scope transparent.\(^5\)

Thus if the whole DP is definite and there is an indefinite inside, the number
of possible readings is six, rather than four. Of these, two are not attested. This is
summarized below.

(24) Embedding DP Embedded DP

| a. Transparent | Wide/Transparent |
| b. *Transparent | Narrow/Opaque |
| c. *Transparent | Narrow/Transparent |
| d. Opaque | Wide/Transparent |
| e. Opaque | Narrow/Opaque |
| f. Opaque | Narrow/Transparent |

For the sake of exposition, we do not go into the details of the uncontroversial cases
where the two DPs agree in transparency. Let us begin with the actually available cases
of disagreeing transparency. Firstly, if the embedding DP is opaque, both mixed readings
are possible. To see this, consider the following example.

(25) Mary thinks that the unicorn that a famous linguist hides from her is beautiful.

Suppose that unicorns do not exist, but Mary believes that they do and in addition that her
father John hides a beautiful one from her. Assume further that he is a famous linguist,
unknowest to Mary. In this context, the sentence is judged true and the reading is such
that the indefinite phrase is read wide scope transparent.

Also, the narrow scope transparent reading of the embedded indefinite is avail-
able for the same sentence. Here is a context: assume that there are group of people in
front of Mary and she is convinced that one of them hides a beautiful unicorn from her,
but has no idea which. Those people are famous linguists, but Mary does not know this
fact. The sentence is again true in this context.

On the other hand, if the embedded DP is read opaque, the mixed readings are
both impossible. Consider the following example.

\(^5\)We again ignore the wide scope opaque reading.
(26) Mary thinks that the semantics paper about a tone language is a phonology paper.

Suppose that there is a semantics paper about French, which Mary thinks is a phonology paper about some tone language that she does not know. In this context, the sentence is judged false, but it would not if the indefinite a tone language could be read narrow scope opaque with the whole DP being read transparent.

Similarly, the indefinite cannot be read narrow scope transparent. Suppose now that there is a semantics paper about Vietnamese. Mary knows that it is about either Vietnamese, Cantonese or Thai, but she is unaware of the fact that these languages are tone languages, and she thinks that the paper is a phonology paper. In this context, the sentence is again judged false, but it would not if the indefinite could be read opaque narrow transparent.

Notice that although the former case is subsumed by the Nested DP Constraint in (19), the latter reading is not. Thus we add an additional conjuct to it:

(27) **Nested DP Constraint**

  a. When a DP is embedded inside a DP, the embedding DP must be opaque if the embedded DP is opaque;
  b. When an indefinites is embedded inside a DP, the indefinite must be wide scope transparent, if the embedding DP is transparent.

### 3.3 Interim Summary

That the intensional variable theory needs the five constraints introduced above suggests that this theory is too expressive, and lacks explanatory power. Although the data can be correctly described with these constraints, they seem rather ad hoc and thus the theory lacks an insight into the nature of the present phenomenon.

Before closing this section, let us examine the scope theory with semantic reconstruction with respect to the same constraints. The scope theory is better than the intensional variable theory in that it does not require the Main Predicate, Adverb and Intersective Predicate Constraints, since they can be attributed to syntactic locality constraints on quantifying-in. That is, it is not inadequate to posit a constraint that forbids quantifying-in of predicates in general. Furthemore, such a locality constraint makes the nested DP constraint unnecessary as well. In the scope theory, the whole DP cannot be transparent with the embedded DP opaque, since such a configuration necessarily involves an unbound trace/variable.

Nonetheless, however, the Presuppositional DP Constraint is independently necessary, as nothing prohibits quantifying-in of a non-presuppositional/cardinal DP. Also, recall that this theory suffers from the conceptual complexity regarding the scope islands. The presupposition projection theory presented in the next section is free from all these conceptual problems.
4 The Presupposition Projection Theory

The presupposition projection theory uses presupposition projection to derive the two readings (Geurts, 1998; Maier, 2006). While Geurts uses the Discourse Representation Theory (DRT) augmented with the Binding Theory of Presupposition, we try to be neutral with respect to the detailed mechanism of presupposition projection in this section. Importantly, however, the flexibility of presupposition resolution is crucial as we will discuss in Section 5.

Specifically, this theory differentiates the two readings by resolving the presupposition of the relevant DP in two different places. Transparent readings obtain when the presupposition is resolved globally, while opaque readings obtain when it is resolved locally. For instance, our initial example is analyzed as follows. The presuppositional parts of the paraphrases are underscored.

\[(28) \text{John thinks that the president is smart.} \]
\[a. \exists ! x: \text{president}(x) \text{ and John thinks that } \lambda x[\text{president}(x)] \text{ is smart} \]
\[b. \text{John thinks that } \exists ! x: \text{president}(x) \text{ and } \lambda x[\text{president}(x)] \text{ is smart} \]

Definite descriptions are typical presuppositional DPs, and their transparency ambiguities are innocuously captured as above. Similarly, strong quantifiers have presuppositions, and exhibit transparency ambiguity. Here we make an assumption that they presuppose the unique existence of their domains and are semantically partitives (Geurts and van der Sandt, 1999; Geurts, 2007).\(^6\) This enables us to describe the transparency ambiguities with strong quantifiers in the following way.

\[(29) \text{John thinks every Canadian is smart.} \]
\[a. \exists ! X: \text{Canadian}(X) \text{ and John thinks that all of } X \text{ are smart.} \]
\[b. \text{John thinks that } \exists ! X: \text{Canadian}(X) \text{ and all of } X \text{ are smart.} \]

Note that just as in the intensional variable theory, the quantificational scope is reckoned independently from the transparency, and hence the scope puzzle does not arise in this theory. For example, the conditional case repeated below is treated as (30-b).

\[(30) a. \text{If every man was a woman, John would be happy.} \]
\[b. \exists ! X: \text{men}(X) \text{ and if all of } X \text{ were women, John would be happy.} \]

4.1 No Need for the Constraints

A good thing about this theory is that it requires none of the independent constraints introduced in Section 3.

The Main Predicate and Adverb Constraints follow from the fact that the nature of presuppositions associated with presuppositional predicates and adverbs is different from the nature of presuppositions of presuppositional DPs (Zeevat, 2002). Simply put,

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\(^6\)As Gennaro Chierchia (p.c.) pointed out to us, there might be some differences between true partitives such as most of the linguists and mere strong quantifiers such as most linguists. However, we believe the differences, if any, are differences in the nature of presuppositions and not fatal for our assumption here.
while presuppositional DPs mention the same individuals or sets thereof in the presupposition and the assertion, the presuppositions of main predicates and adverbs are always about different sets of individuals, properties, events, situations etc. This lack of direct anaphoric dependency between the presupposition and the assertion straightforwardly explains why transparency ambiguity does not arise with main predicates and adverbs.

The Intersective Predicate Constraint does not have to be stated independently either. Specifically, the presupposition of a DP is triggered by D, and the NP meaning becomes part of the presupposition as a whole. Consequently, its subconstituents just cannot be separated. Similarly, the Presuppositional DP Constraint is just what this theory predicts.

Furthermore, the nested DP constraint straightforwardly follows from interpretability (cf. trapping of van der Sandt, 1992). Let us look at the non-indefinite case first. The assumption here is that presuppositions cannot contain free variables. For instance, in the following example, the only felicitous reading necessarily contains a free variable \( y \).

(31)  
\[
\#\text{Mary thinks that the man who likes the unicorn is a woman.}
\]

a. \[\exists!x : \text{man}(x) \text{ and like}(x, y) \text{ and Mary thinks that } [\exists!y : \text{unicorn}(y)] \text{ and } x \text{ is a woman.} \] (T-O)
b. \[\exists!y : \text{unicorn}(y) \text{ and Mary thinks that } \exists!x : \text{man}(x) \text{ and like}(x, y) \text{ and } x \text{ is a woman.} \] (O-T)
c. \[\exists!x, y : \text{unicorn}(y) \text{ and man}(x) \text{ and like}(x, y) \text{ and Mary thinks that } x \text{ is a woman.} \] (T-T)
d. \[\#\text{Mary thinks that } \exists!x, y : \text{unicorn}(y) \text{ and man}(x) \text{ and like}(x, y) \text{ and } x \text{ is a woman.} \] (O-O)

### 4.2 Wide Scope Indefinites and Presuppositions

As we have already seen, indefinites can be interpreted transparent as well, but a problem here is that indefinites are generally considered non-presuppositional. It has been well known, however, that indefinites are different from other quantifiers in that they can take exceptional wide scope, and we maintain that whatever is responsible for the exceptional wide scope is also responsible for the wide scope transparent reading. For example, the wide scope transparent reading of the following example is captured as in (32-b).

(32)  
\[
\begin{align*}
\text{a. Mary thinks that a plumber is cool.} & \\
\text{b. } \exists x : \text{plumber}(x) \text{ and Mary thinks that } x \text{ is cool.}
\end{align*}
\]

Nothing so far subsumes the narrow scope transparent reading of indefinites, but this also can be given a natural explanation. Namely, we assume that indefinites can be interpreted as partitives too. It is widely acknowledged that weak/non-presuppositional quantificational determiners can also be interpreted as strong/presuppositional, which we assume to be a partitive reading (Geurts and van der Sandt, 1999; Milsark, 1977), and there seems to be no reason to exclude indefinites from this generalization. Thus, Fodor’s example of the scope puzzle with an indefinite is captured as follows.
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(33) a. Charley wants to buy a coat like Bill’s.
b. \[ \exists X : \text{coats-like-Bill’s}(X) \text{ and Charley wants to buy one of } X. \]

Furthermore, this account nicely predicts the interaction of wide scope indefini-
tes and transparency stated in the second conjunct of the Nested DP Constraint. That
is, when an indefinite is embedded inside a DP, the indefinite must be wide scope trans-
parent if the embedding DP is transparent. This pattern straightforwardly follows from
the interpretability. The relevant cases of the example in (26) would look as follows
where \( y \) is free in the impossible readings.

(34) Mary thinks that the semantics paper about a tone language is a phonology
paper.
a. \[ *\exists Y, x : \text{tone-langs}(Y) \text{ and sem-paper}(x) \text{ and about}(x, y) \text{ and Mary thinks } \exists y \in Y \text{ and } x \text{ is a phonology paper.} \] *(T-N/T)
b. \[ *\exists x : \text{sem-paper}(x) \text{ and about}(x, y) \text{ and Mary thinks } \exists y : \text{tone-lang}(y) \text{ and } x \text{ is a phonology paper.} \] *(T-N/O)
c. \[ \exists y : \text{tone-lang}(y) \text{ and } \exists x : \text{sem-paper}(x) \text{ and about}(x, y) \text{ and Mary thinks John is reading } x. \] *(T-W/T)

Thus, if the embedding DP is read transparent, the only choice for the embedded indefi-
nite is also wide scope transparent, which is exactly what we want. Although we do not
show them here, the other readings are also correctly accounted for.

From the above discussions, we conclude that the presupposition projection the-
ory is conceptually better than the previous two theories and that transparency ambiguity
should be treated as a presuppositional phenomenon.

5 Theories of Presupposition Projection

The idea of treating transparency ambiguity as a presuppositional phenomenon is ba-
sically independent of the theory of presupposition projection. However, one thing it
demands is that presupposition resolution be flexible enough so that there is a choice as
to where the presupposition can be resolved. In other words, a theory that treats presup-
position projection as a kind of scoping mechanism is necessary. The Binding Theory
of Presupposition due to van der Sandt (1992) has this crucial feature, and the theories
due to Geurts (1998) and Maier (2006) are couched in this framework. We simply refer
the reader to those studies for the details of this account, and in this final section, we
examine other representative theories of presupposition projection with regards to the
flexibility of presupposition resolution.

The Satisfaction Theory (Heim, 1992; Karttunen, 1973) is one of the most es-
poused theories of presupposition projection. It attributes the projection behavior of a
presupposition to the lexical nature of the operator that embeds the presupposition. In
this framework such operators are divided in three different classes: holes, plugs and
filters. Holes always let the presuppositions embedded in them project up, plugs always
block them, and filters sometimes let them and sometimes do not. For what concerns us
here, attitude predicates are assumed to be plugs. Thus, while (35-a) presupposes (35-b), (35-c) does not.\(^7\)

(35)  
  a. The king of Buganda is bald.  
  b. Buganda is a monarchy  
  c. Fred thinks that the king of Buganda is bald.

However, if transparency ambiguity is to be treated as a presuppositional phenomenon, as suggested above, this theory will only yield the opaque reading of the definite DP in (35-c)\(^8\).

Besides the Satisfaction Theory and the Binding Theory, a series of new theories have been recently proposed. Among these, we discuss the Transparency Theory (Schlenker, 2008) here. This theory treats the phenomenon of presupposition projection with the combination of a static semantics plus two violable pragmatic principles, *Be Articulate* and *Be Brief*. The former requires that a sentence \(pp'\), where \(p\) is the presupposition of \(p'\), be expressed as \(p \text{ and } pp'\), whereas the latter requires that \(p\) be not pronounced whenever it is pragmatically useless. For example (36-a) would be in accordance with *Be Articulate*, but not with *Be Brief*. As the latter is more highly ranked than the former by assumption, the less expressive form in (36-b) is the one usually chosen.

(36)  
  a. Buganda is a monarchy and the king of Buganda is bald.  
  b. The king of Buganda is bald

In the case of attitude predicates the same reasoning can be applied and normally (37-b) would be chosen over (37-a) and this would give the opaque reading of the DP.

(37)  
  a. John thinks that Buganda is a monarchy and the king of Buganda is bald.  
  b. John thinks that the king of Buganda is bald.

However, *Be Articulate* as defined in Schlenker (2008) cannot derive the transparent reading as it requires the conjunction \(p \text{ and } pp'\) to appear immediately before the sentence \(pp'\), i.e. as \(p \text{ and } pp'\). In order to derive the transparent reading, one has to modify the definition of *Be Articulate* so that it also demands (37-a) to be expressed as (38).

(38) Buganda is a monarchy and John thinks that the king of Buganda is bald.

To sum up, what is needed for a presupposition theory is some level at which the transparent and opaque readings can be represented as different ways of solving the presupposition. In the case of the Binding Theory, this is encoded at the level of discourse representation, but as we have seen in this section, other options are possible in other theories, for example, in the lexical semantics and in pragmatic principles. A further examination of these alternatives, however, is deferred to future work.

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\(^7\)For Heim (1992) and Karttunen (1973), a sentence of the form \(x \text{ believes } p_{(q)}\), where \(q\) is the presupposition of \(p\), presupposes that \(x \text{ believes } q\).

\(^8\)One solution would be to assume that attitudes are filters, specifying the conditions under which the presupposition would not project.
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References


German \textit{her}, \textit{hin}, \textit{hin- und her}, and \textit{herum}:
Meaning and Justification of Direction and Change of Direction in Perceptual Space

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Abstract
The paper presents a case study in the compositionality of particle-motion-verbs. Part of the investigation is the interaction between indexical elements contributed by \textit{hin}- (there, thither) vs. \textit{her}- (here, hither) and the deictic motion verbs \textit{kommen} (come) vs. \textit{gehen} (go). The investigation will lead to a distinction between the notion indexical in the sense of 'direct reference to the utterance situation' on the one hand and 'perspectival' as an attitudinal notion on the other. Both dimensions of context dependency are formalised in DRT-based lexical entries applied in a construction algorithm for multiple presupposition construction along syntactically driven principles. These principles are also shown operative in \textit{hin- und her-α} and \textit{herum-α}–descriptions of motion, both lacking reference to the utterance situation. The latter phenomenon is due to a general principle of self-location.

1 Introduction

German has a pair of particles \textit{hin} and \textit{her} specifying direction of motion which are interpreted w.r.t. the utterance location. They come close to English 'thither' and 'hither', respectively, which, however, seem oldfashioned or out of use. A German speaker naturally marks a motion of someone approaching him adding the particle \textit{her}- to the motion verb, as in \textit{Warum rennt der Hund her}? (Why does the dog run here?). He will also mark motion in the opposite direction adding \textit{hin}-.. If he is in the rear of the motion rather than in its front, we will ask e.g. \textit{Wo rennt der Hund hin}? (Where does the dog run (to)?). The first important question in this paper is whether \textit{hinrennen} and \textit{herrennen} can be reconstructed as compositional from the contribution of \textit{hin}- or \textit{her}- on the one hand and \textit{rennen} (run) on the other. I will tackle the problem by making the idea of self-location in the front or rear of the directed motion operative. The puzzle seems harder with the double-particle construction \textit{hin- und herrennen} as in \textit{Warum rennt der Hund hin- und her}?, which translates as 'running back and forth'. In this complex verb \textit{her}- does not
refer to the utterance location and hin- does not indicate either where the speaker is. In one prominent use hin- und her- indicates iteration of changing direction which pragmatically implies running without a goal. German has another double particle construction with the latter meaning, i.e. herumrennen, with the particle um next to her. For um we can assume that it contributes change of direction as well in some way or other.

Concerning the issue of compositionality a first glance already reveals that we need at last a semantics for the particles contributing direction, i.e. hin- and her-, as well as for um-, and for the contribution of the motion verbs. But given that we can make the semantics of the particles precise as they occur in, say, hinrennen and herrennen, is their semantic contribution the same in the case of hin- und herrennen? — Hardly so, it seems, because herrennen is interpreted with respect to the speaker’s self-location whereas the coordinated hin- und herrennen is not. Hin und her- are interpreted as direction and counter-direction in the motion sequence independent of the speaker’s self-location. So the indexical particles come in different colours, and the question arises what makes them change their colour. This will be the leading question in section 2. Hin- and her- are sensitive to the utterance situation. There are verbs also known as context sensitive in this way, i.e. come and go, German kommen and gehen. Is the meaning of a combination of a context sensitive verb and a context sensitive particle predictable from their parts? This will be discussed in section 3. Section 4 will be devoted to herum- double particle constructions.

1.1 Background assumptions

The particles, we said, specify direction or change of direction. What is it, then, that the direction or change of direction is specified of? Per hypothesis this is the rectilinear path described with the help of manner-of-motion-verbs like rennen and fahren or deictic motion verbs like kommen and gehen. This hypothesis is a background assumption from more general research on space in Natural Language, see Kamp and Roßdeutscher (2005).

1.1.1 motion verbs

We believe that space as seen through the eyes of natural language has a simple geometry. Spatial directions are as much as possible conceived in such a way that all directions expressed in natural languages are conceptualised as following one of the three axes of Primary Perceptual Space (PPS), a notion adopted by Lang (1989). The principal determinants of PPS are the vertical axis VERT(ical) and the horizontal plane HOR(izontal), which is perpendicular to VERT. Events as they are described by motion verbs are rectilinear motions which follow one of the three axes of PPS. This assumption of the Primacy of Orthogonality relies on two empirical hypotheses on lexicalisation patterns in languages like German or English. First, there are no simple change-

\[1\] I do not claim, that the occurrences of the verbs as a whole or their complex parts are always composed ‘online’ according to some rules. But even if they are listed in the lexicon an answer to my question to which extent the interpretation of the constructions is rule based will help us to understand the lexicon better.
of-location-verbs that describe only motions that are neither along the VERTICAL nor in the HORIZONTAL. Second, there are no simple change-of-location-verbs that describe only motions that are not rectilinear. Walk, run and drive describe motion in the horizontal, whereas fall, sink, rise along the vertical axis. But there are no verbs that lexicalise angular motion alone. You cannot but express the angular rising of a plane into the sky by using the verb steigen (to ascend, to rise), i.e. the same verb you use describing the straight vertical motion of, say, a balloon. We assume that the path w(eg) of a movement e (which is reminiscent to a path-concept of Kurt Eberle) is conceived of as a continuous 1-dimensional rectilinear region, and that the target y which moves along it is conceived as a point. This simple geometry sufficiently models what motion verbs express as the modificandum for the particle’s contribution of direction and change of direction. The semantic analysis of the particle verbs will provide further evidence for the primacy of orthogonality because changes of direction in 90 degrees in the horizontal will be decisive to qualify for such changes expressed by means of the particles.

A lexical entry for the German motion verb fahren (drive) has the following form:

\[
\text{fahren}: \left\langle \begin{array}{c}
y \\
\text{weg(eg)=w MOVE(e,y)} \\
\text{DRIVE(e,y) w \perp VERT}
\end{array} \right\rangle
\]

There is a binding condition for the referential argument e and for an argument slot y for the theme, such that fahren specifies a two-place relation DRIVE of a motion type between the theme y and the event e. The path of the (rectilinear) motion w is specified as perpendicular to the vertical of PPS. (As we look exclusively at motion in the horizontal we will skip the latter condition in the semantic representations.)

1.1.2 FRONT and REAR of a motion, her- and hin-

While traversing its path the moving target y determines for each time t two half-planes of the horizontal; namely the FRONT of the motion e and the REAR of the motion. So the following axiom is part of the geometry that serves as the model for space as expressed in motion descriptions.

\[
\text{MOVE(e,y,t)} \Rightarrow \text{HOR = FRONT(e,y,t) \cup REAR(e,y,t)}
\]

Let us assume that there is an observer of the motion. For each time t the observer can estimate whether the target y is approaching or whether it is disappearing. In other words: the observer either locates himself in the front of the motion, justifying the choice of her or else she localises herself in the rear of the motion. This justifies hin. That characterisation leaves open whether or not the observer locates herself at some point on the (estimated) path. It is only when endpoints of the motion come into play that the question whether the observer locates herself in the FRONT (or in the REAR) on the path becomes decisive for the lexical contribution of hin- and her-, see section 2. The direction as required by hin- and her- is sufficiently determined by the self-location of
the observer in the respective half-planes, \textsc{Front}(e,t) or \textsc{Rear}(e,t) defined for some particular t during the motion e.

Think of someone walking in the fields seeing at some time t a dog running towards him. As said in the introduction he will speak to himself or to someone walking by his side in terms (1).a. If the dog is running away from him he may utter (1).b.

\begin{enumerate}
\item a. Warum rennt der Hund her?
\item b. Wo rennt der Hund hin?
\end{enumerate}

\begin{tabular}{l}
\textit{why run the dog [hither]} \textit{where run the dog [thither]}
\end{tabular}

\begin{tabular}{l}
\textit{‘why is the dog running here?’} \textit{‘where(to) is the dog running?’}
\end{tabular}

If the man localises himself in the front of the movement it is unnatural for him to say \textit{der Hund rennt irgendwo hin} (lit. the dog is running somewhere thither). He will also definitely not use \textit{her-} if he is in the rear of the movement. Or think of the man having his dog close ordering him to stay put. He will say \textit{Du rennst nirgendwohin!} (You are running nowhere!). But if the dog is somewhere distant and should not join the man he will shout \textit{Du rennst nicht her!} (You are not running here!). In the former case the speaker localises himself in the rear of the motion whereas in the latter in the front of the motion.

With the notion of the \textsc{Rear}(e_{\alpha}) and the \textsc{Front}(e_{\alpha}) of the motion we have the conceptual and formal clue for presenting the contribution of \textit{hin-} and \textit{her-}, see (2): If some observer is present, his self-location is a spatial reference point \( r_{0,i,n} \). We make the element of self-location of the observer explicit in the subscript ‘i(ndex)’, and a temporal index n(ow): \( r_{0,i,n} \).\(^2\) I present the contribution as a pair of presupposition and assertion. The event variable is free in (2).

\begin{enumerate}
\item a. \textit{her:}
\item b. \textit{hin:}
\end{enumerate}

\begin{align*}
\text{(2)} & \quad \left\{ \begin{array}{c}
\{ r_{0,i,n} \} \\
1_{0,i,n} \subseteq \text{Front}(e_{\alpha})
\end{array} \right\} \\
\text{her-} & \text{ is indexical. It requires that a reference point is resolved or accommodated in the front of the motion the description of which it is a part. \textit{hin} is anti-indexical and requires a reference point } r_{1} \text{ in the front of the described motion, where } r_{1} \text{ is different from its indexical counterpart which is in the rear of the motion.}\(^3\) Both the indexical } r_{0,i,n} \text{ in the rear and the anti-indexial } r_{1,i,n} \text{ in the front must be justified in context.}
\end{align*}

In (3) the presupposed anti-indexical reference point \( r_{1} \) is provided by the linguistic context. The man sees the dog running now and again to some particular spot in the field. He speaks to himself or to someone in his company, thereby introducing a description for the particular spot in the first sentence. The presupposed anti-indexical...

\(^2\)We have already alluded to the fact that the reference point need not be the self-location of the speaker \( r_{0,i,n} \) but might actually also be some arbitrary reference point \( r_{0}, \) see next section.

\(^3\)In the context of motion verbs we could strengthen the entry of \textit{hin} adding a further condition: \( r_{1,i,n} \subseteq w, \text{wegen}(w,e_{\alpha}) \). But this would not generalise to other verbal contexts that specify direction but no path, say, \textit{vor sich hinreden} (to mauler) or \textit{hin- und herwackeln} (to wiggle to and fro). This is why I leave the entry as is.
reference point \( r_1 \) is then resolved as anaphoric with respect to the explicitly introduced reference point in context.

(3) Da muss ein Kaninchenloch sein. W arum rennt der Hund sonst hin?
'There must be a rabbit hole. Why else does the dog run [hin]'

### 2 hin- und her-rennen

*Warum rennt der Hund hin- und her?* is interpreted as a sequence of motion in some direction and its counter-direction and the reference points are interpreted as arbitrary, independent of the utterance place. This is not in line with the assumptions made in section 1 but the case can be accounted for. Let us, paving the way towards a solution of the puzzle, look at a description of a sequence of events of the dog’s running first to the rabbit hole and then towards the speaker again. Let’s also assume that the sequence occurs before the utterance time. The description may have the form (4).

(4) Der Hund rannte hin und rannte her.
'The dog ran there (e\(_1\)) and ran here (e\(_2\))'

The description of the sequence e\(_1\) \( \prec \) e\(_2\) is a sequence of descriptions of rectilinear motions. Its dynamic semantics is as follows. e\(_1\) has \( r_{11} \) as its goal. Following entry (2) the *hin-* description presupposes some reference point \( r_{11,n1} \neq r_{01,i,n1} \), such that \( r_{11,n1} \subseteq \text{FRONT}(e_1) \) and \( r_{01,i,n1} \subseteq \text{REAR}(e_1) \). \( r_{11,n1} \) is the ‘place reached within the story’ made of e\(_1\) and e\(_2\); it is a specific place (and the context is more natural if there is an explicit antecedent in the context). The *her-* description of e\(_2\) requires according to (2) a reference point \( r_{02,i,n2} \), which is located in \( \text{FRONT}(e_2) \).

We can assume now that the spatial perspective point is stable and we yield the condition that the self-location at the beginning of the event sequence does not change. So we have two self-locations, both at the same place, i.e. \( r_{01,i,n1} = r_{02,i,n2} \).

So far we have reconstructed descriptions with *hin-* und *her-* as a sequence of a theme running to some (definite) place distant from the speaker’s place and then approaching again, as a special case of a sequence of motions in some direction and it’s counter-direction.

**Primacy of Orthogonality.** What qualifies as a change to counter-direction? A full turn of 180 degrees of the moving target of course target will do, but less dramatic changes can also be felicitously described in terms of *hinrennen und herrennen* or *hin- und herrennen*. However, the change must be one in more than 90 degrees. It is only then, that \( r_{01,i,n1} = r_{02,i,n2} \) is located both in some half-plane qualifying as \( \text{REAR}(e_1) \) and some half-plane qualifying as \( \text{FRONT}(e_2) \) (compare Figure 1, where the arrows represent the motions e\(_1\) and e\(_2\) and the lines the border between \( \text{FRONT} \) and \( \text{REAR} \) of e\(_1\) and e\(_2\), respectively.)

That latter condition and the confirmed assumption that motion descriptions are descriptions of those motions as following one of the three axes of PPS support the outstanding role of orthogonality in motion descriptions, see sec. 1.1.
What makes \( r_{01,i,n1} \) and \( r_{02,i,n2} \) loose their indexical colour in \( \text{hin-und her} \)-descriptions and makes them interpreted as arbitrary spatial reference points as given in \( r_{01} = r_{02} \) (see Figure 1)? Crucial in this respect, I claim, is whether \( \text{hin- und her} \) serves as a complex modifier of one tensed verbal description \( \alpha \). If the sentence can be understood as a sequence of two descriptions, then the reference points can be interpreted as referring to the utterance place. For instance, \( \text{Der Hund rannte hin und wieder her} \) (He ran there and back here, again) must be reconstructed as elliptical, where the second occurrence of the verb is elided, but semantically present. But \( \text{hin- und her} \) as in the simple \( \text{der Hund rannte hin- und her} \) (the dog ran back and forth) is understood as one event complex \( e \) such that \( e \) is a mereological sum of \( e_1 \) and \( e_2 \), displayed now and later as \( 'e = e_1 \oplus e_2' \). We have one utterance time \( n \), instead of two for the description of the complex \( e \). Let’s counterfactually assume that there would be one utterance time \( n \) of the description of \( e \), but two self-locations \( r_{01,i,n1} \) and \( r_{02,i,n2} \). How would they be related to \( e \)? — \( r_{01,i,n1} \subseteq \text{REAR}(e) \), because \( r_{01,i,n} \) is in \( \text{REAR}(e_1) \) and \( r_{02,i,n} \subseteq \text{FRONT}(e) \), because it is in \( \text{FRONT}(e_2) \). So the speaker would have to split his self-location at utterance time \( n \) of the description \( e \) into two different perspectives on \( e \), being in the front and in the rear of the complex motion \( e \) at the same time. But this is impossible. (N.B. Under this impossible assumption the anti-indexical \( r_{11,i,n} \) is neither in the rear nor in the front of \( e \), for it is in the front of \( e_1 \) and in the rear of \( e_2 \). Indeed \( r_{11,i} \), the ‘place where \( e_1 \) ends up’, has no specific interpretation in simple \( \text{hin- und her} \)-descriptions, which it has in a sequence of descriptions like (4). In a single utterance description of an event complex it serves as an arbitrary point of return on the path of \( e \).) Let us summarise what our counterfactual assumption shows: Self-location is bound to utterance time. One utterance, one self-location. Self-location can either be in the front or in the rear of the motion. If a single utterance describes a sequence of motion in some direction and counter-direction the indexicals cannot be interpreted with respect to the speaker’s self-location. This prediction also covers \( \text{herum-\( \alpha \)} \) double-particle constructions, which are also one utterance descriptions of event complexes, see section 4. \( \text{hin- und her} \)-constructions must be analysed as double particle constructions as well.
3 her-α vs. hin-α and kommen vs. gehen

On the face of it there is a correlation between indexical her-α descriptions and kommen (to come) on the one hand and anti-indexical hin-α -descriptions and gehen (to go) on the other. That correlation seems to gain substance by the fact that given our field scenario the utterance of (5) is as natural as (1).a, if not more natural.

(5) Warum kommt der Hund? / Warum kommt der Hund her?
′why does the dog come?’ / ′Why does the dog come [here]’.

Is there any difference between herrennen and kommen or herkommen at all? As far as the data presented there isn′t and the entry of her- resembles the one for kommen in Roßdeutscher (2000). (The resemblance will be made precise in the following.) Given that resemblance we would not be surprised if kommen and hin- were incompatible. And indeed, if we substitute rennen with kommen in (6), we yield a weird context:

(6) # Da muss ein Kaninchenloch sein. Warum kommt der Hund sonst hin?
# ′There must be a rabbit hole. Why else does the dog come there’

But the matter is more complex: Neither have kommen and herrennen the same semantics nor are kommen and hin- incompatible. The data (7) illustrate the differences. The context is fixed as part of a conversation taking place in Stuttgart, speaking of tomorrow′s party at Tübingen.

(7) Speaker in Stuttgart:"Morgen ist in Tübingen eine Party...
a. ... Kommtst du auch?’
b. ... # Kommtst du auch her?’
c. ... Kommtst/fährtst/gehst du auch hin?’
d. ... Kommtst/fährtst/gehst du auch hin und kommtst/fährtst dann wieder her?’
e. ... Kommtst/fährtst/gehst du auch hin und *gehst dann wieder her?’

The surprising data are (7).b and (7).c as opposed to (7).a. Assuming that kommen is indexical (which is a natural assumption) (7).a. is known as counter-evidence against both seminal theories of indexicality, Fillmore′s as well as Kaplan′s. See Roßdeutscher (2000) for detailed discussion. Recall that Fillmore (1983) in this analysis of come as an indexicals predicts that come implies that the speaker or the addressee is at the goal of the motion, either at coding time (= utterance time) or at arrival time. But neither is guaranteed here: neither is the addressee′s perspective chosen nor necessarily the speaker′s, because it doesn′t follow from (7).a that the speaker will be at the goal tomorrow. So Fillmore′s theory must be qualified or rejected. And, again assuming that kommen (to come) is indexical, Kaplan′s theory predicting direct reference at the goal of the motion must be rejected or qualified just as well. For his theory on indexicals in Kaplan (1989) excludes any shifts of indices. Denying kommen indexical status right away does not present itself as promising taking the weird context (6) into account, where the anti-

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4We ignore differences in manner specification.
5The example (7).a goes back to Cinque (1973).
indexical *hin-* and *kommen* apparently conflict. Why should they conflict if not with respect to indexicality? On the other hand (7).c with *hinkommen* is as felicitous as with the manner of motion describing *hinfahren* (drive thither)\(^7\). Thus the solution to the puzzle must be sensitive to the difference between contexts like (6) and (7).c in the first place. The puzzle has been solved already in the theory of *kommen* in Roßdeutscher (2000): *Kommen* requires an attitude bearer in the front of the motion, a person. That contextually provided attitude bearer is ascribed the attitude of localising himself in the front of the *kommen*-motion. This solves the puzzle of the felicitous (7).c on the one hand and the infelicitous (6) on the other: While there are naturally attitude bearers at the party venue the perspectives of whom justify *kommen*’s requirements,\(^8\) there aren’t any attitude bearers at rabbit holes, unless this is explicitly mentioned. Consequently the speaker who describes the motion cannot choose a perspectival description of motion in (6). The speaker in (7) has that option because an attitude bearer can be justified in the front of the motion at the party venue (at the goal) in (7).a, c, d, e for the first motion and he himself is an attitude bearer at the goal of the second motion in (7).d. This option to select *kommen* also obtains in (1).a, and (5). The speaker opts for a non-perspectival motion description in the former and for a perspectival one in the latter. Selecting *kommen* and thereby rejecting *fahren* or *rennen* means making a choice.

This, however, is not so in the selection of *her-* and non-selection of *hin* in *herrennen* in (1) or *herkommen* in (5) (as opposed to *hirenennen* in (1), nor in the selection of *herfahren* or *herkommen* in the description of the second motion in (7).d. The speaker has no choice. The selection is determined by what is actually the case in the utterance situation: The speaker is in the front (at the goal) of the motion and he localises himself there. This actual self-location of the speaker at the indexical ‘here’ and ‘now’ of the utterance situation (\(r_{0,i,n}\) in (2)) determines the use. And by the same token the region of self-location \(r_{0,i,n}\) is the goal-denotation interpreting *her-* in *her-\(\alpha\)-descriptions. No other interpretation is possible.

Different from *come* or *kommen*, *her-* is an indexical in the sense of ‘direct reference’ claimed for indexicals in general by Kaplan (1989). This strict notion of indexicality as ‘direct reference’ can be observed in (7).b. In this context (as in any other) *her-* can only refer to the utterance place. *her-* can neither be justified as the self-location of some party-goer at arrival time nor as the prospective self-location of the speaker as it is possible with *kommen* (compare fn. 8). Counterfactual contexts as the following provide further evidence for the directly referential behaviour of *her-\(\alpha\)* as opposed to the perspectival *kommen*.

(8) Speaker in Stuttgart:

a. "Wenn ich in Reutlingen wäre, würdest du auch kommen."
   'If I were in Reutlingen, you would come, too.'

b. "Wenn ich in Reutlingen wäre, würdest du auch herkommen”.
   'If I were in Reutlingen, you would come here, too'.

---

\(^7\)We leave aside *gehen* for the moment, coming back to it soon.

\(^8\) It is possible that the speaker is ascribing himself an attitude towards the addressee’s motion to obtain at the arrival time. But this is not necessarily so, as Cinque (1973) correctly observes.
In (8).a the speaker chooses the perspective of counter-factual self-location of himself in Reutlingen, i.e. at the goal of the counterfactual motion. (The speaker might allude to the fact that wherever he was the addressee would end up.) In (8).b the counterfactual motion ends at Stuttgart, the actual place of the speaker’s self-location. (Here she might allude to the fact that it is not because of her that the addressee pays a visit to Stuttgart or that the addressee might even avoid Stuttgart, unless the speaker is absent.) It is compatible with what I claimed that justification of her- and of kommen may be different in one and the same complex predicate herkommen.9 With hinkommen the justification of the anti-indexical hin-, which presupposes an indexical anchor in context and the perspectival kommen are necessarily independent. (7).c is an example. The indexical reference point r0,i is the utterance location in the rear (at the source) of tomorrow’s motion and the attitudinal state which is required by kommen is ascribed to one of the party-goers in its front. For good measure I will represent how the requirements are constructed and justified in a syntax driven bottom up construction algorithm, see next subsection.

Before I do this I still have to discuss how gehen fits in. I have said that her- is indexical in the sense of ‘direct reference’, hin- is anti-indexical but presupposes some indexical reference point in the REAR and that kommen is perspectival. It goes without saying that there is no indexical nor attitudinal requirement with manner of motion verbs like fahren. A speaker selecting fahren as opposed to kommen in (7).c, d, or e refrains from taking perspective. What is the impact of selecting gehen as opposed to kommen in (7).c and (7).d and why is (7).e ungrammatical? Is gehen indexical or anti-indexical in some sense? And if so, is it a matter of self-location of the speaker in the rear of the motion or a matter of choice of someone’s perspective in the rear of the motion? Is (7).e ungrammatical because gehen is (anti)-indexical? There is no semantic difference in hingehen as opposed to hinfahren in (7).c, d. But this doesn’t say much, because of the anti-indexical hin.

My explanation of why (7).e is ungrammatical is unspectacular. It is grosso modo as follows. Gehen is initial-oriented, whereas her- is final-oriented (in the sense of Fillmore (1983))10. We can make the notion operative in assuming that gehen requires

9 This theoretical possibility arises in (8).b. (in contrast to (8).a where no direct reference comes into play). Beyond doubt her- is justified because the speaker actually self-locates himself at the utterance place Stuttgart, in the front of the (counterfactual) motion. But kommen might be justified by taking the perspective of some other person in Stuttgart. In the more ‘technical’ sense made operative in the present paper this means that the speaker ascribes to some person in the counterfactual world in Stuttgart that this person believes himself in the front of the motion. It is more plausible, however, to assume that the speaker chooses his own perspective on the counter-factual motion: he self-ascribes the belief of (actually) being at some place that would be in the front of some motion which would occur in the counterfactual world.

10Note that Fillmore’s exclusion implication (A) in Fillmore (1983) ‘The speaker is not at the goal of the motion.’ for go or gehen seems to indicate indexicality for go, too. As evidence he presents the ungrammatical *Go here! or *Geh her!, and the evidence for (A) seems overwhelming. Still it is the combination of go and the directly referential here that is ungrammatical and the implication (A) might not be provided by go on its own. Does, for instance, the utterance of Go! Go! Go! imply that the speaker is not at the goal? Consider a group of soccer fans sitting behind the opponent’s goal shouting encouragement for their favourite team heading for the goal. Could this scenario challenge Fillmore’s rule (A)? I want to leave this question unanswered. (For this would require an extended comparison of the accounts, which we must leave for another occasion). Nevertheless I would like to express my doubts in
some reference point \( r_0 \) in the rear of the motion, see (10) below. *her-* requires its indexical reference point in the front thereby being final-oriented. Thus the contextual requirements of *gehen* and *her-* would be contradictory. As a consequence *hergehen* is an impossible word.  

Is *hergehen* really an impossible word? What about *hin- und hergehen* in *Der Mann ging hin- und her* (The man went back and forth)? The latter is felicitous, but note that there is no indexical colour in *hin-* or *her-* in that one utterance description of \( e = e_1 \bigoplus e_2 \). *her-* does not refer to the utterance location of the speaker. The contextual requirement of *gehen* is fulfilled: \( r_{01} \subseteq \text{REAR}(e) \) because \( r_{01} \) is in the rear of the *hin-* motion \( e_1 \), which solves the *gehen*-requirement; and \( r_{02} \subseteq \text{FRONT}(e) \), because \( r_{02} \) is in the front of the *her-* description \( e_2 \). So the condition \( r_{01} = r_{02} \) obtains which is decisive for the interpretation of the sentence as describing a sequence of motions in some direction and counter-direction. It is not the impossible verb *hergehen* that we face in *Der Mann ging hin- und her*, but the verbal construction *hin- und hergehen* built according to the rules we are about to formulate as constraints to apply in a bottom-up semantics construction algorithm.

### 3.1 Semantics construction algorithm

Semantics construction of the particle verbs in question is basically a matter of constructing and justifying the contextual requirements that stem from the particle and the verbal roots. It can be seen as a special case of constructing preliminary semantic representations which are justified in context in a second step, as familiar from Kamp (2001). What is novel is the fact that the construction is below word-level. Lack of space does not permit for going into the of word-syntactic principles which I assume underlying word-formation. I confine myself here to structures that separate the contribution of the verb and subject on the one hand and of the particle on the other. I will also simplify the semantic representation of attitude ascription to what is indispensable for the purpose of the paper. (See Genabith et al. (2006) for recent standard representations.) I also simplify the entry for the indexicals leaving out the temporal index of self-location.

I have chosen the semantics construction of *hinkommen* with the addressee as subject (occurring in (7).b) for a demonstration of how the composition can be modelled in a unification based framework on the basis of lexical entries, see (9), to be read bottom up.

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(A) as follows: Had Fillmore taken an example like *Go! Go! Go!* as evidence for rule (A), the evidence of (A) would not have been overwhelming at all. N.B. According to the present account *Go! Go! Go!* just means *Move! Move! Move!* — forward, though. The reference points \( r_0 \) in the rear required by *go* are in the respective backs of the players.

11 In *hingehen* the requirement of *gehen* for some reference point \( r_0 \) in the rear of the motion is fulfilled in virtue of the requirements of *hin-*. 

Kommen is represented as a two-place relation between the referential argument and the subject of the sentence. The referential argument e is represented as a binding requirement that is due to be resolved at a Tense-projection, omitted here. Kommen does not specify any manner of motion but plain motion, represented as a prime in the representation language. Its presupposition component is presented in a DRS in curly brackets to the left of the assertion of the verbal head. As informally discussed kommen requires an attitude bearer x who is located at the region r_x and locates himself in the front of the motion, represented here as an attitude of belief (BEL). (The indexical r_i in the belief context, representing the attitude bearer’s 'here', is bound to r_x in the main DRS, in accordance with general assumption of binding of indexical discourse referents in belief contexts). The node representation of the particle is a copy of (2).b, except that the variable e representing the event the direction of which hin- modifies is underlined indicating that the variable has to be bound in the course of the construction.

Interpreting the merge of the adjoined particle node and the VP obeys the following principle of justification of non-heads and heads in sublexical context. I dub it “Obey head requirements!” (OHR).

OHR Justify the contextual requirements in the semantic representation of the non-head-node in the context of the representation of the head-node.

For hinkommen this means (i) substitute the binding requirement e by the referential argument e of the verb; (ii) justify the anti-indexical reference point r_1 as the region r_x of
the attitude bearer x presupposed by komm(en). \( r_1 = r_x \). The resulting VP representation contains already the relevant conditions of the preliminary sentence representation of (7)b. I only describe briefly how these context requirements are justified with respect to the linguistic and the situational context in (7): (i) \( r_{0,i} \) is resolved as the speaker’s (actual) self-location at speech time. (ii) \( r_1 = r_x \) is resolved in context as the party venue in Tübingen, introduced in the previous sentence. (iii) The attitude bearer x must be accommodated and easily is so: party venues inhabit party-goers from the perspectives of whom the motion is described. So much for hinkommen.

In the construction of herkommen, \( r_{0,i} \) in the representation of the particle node is resolved as \( r_x \) in the verbal node representation. We yield \( r_{0,i} = r_x \). As \( r_{0,i} \) must be justified indexically (directly referential) as the speaker’s self-location the attitude bearer x will be resolved as the speaker, too (Compare fn. 9). This leads to incoherence of the context (7) with (7)b occurring therein.

I end this section by displaying the terminating construction of the impossible word *hergehen.

The construction terminates because \( e \) in the particle representation must be bound by \( e \) in the verb’s representation which would yield contradictory requirements \( r_0 \subseteq \text{FRONT}(e) \) and \( r_0 \subseteq \text{REAR}(e) \). But why can \( e \) undergoing failure of resolution not be accommodated to the effect that the modified VP describes a sequence \( e' \prec e \) of motions towards the speaker and away from him again? — Because this would violate OHR. The sequence as a whole would not qualify as a gehen-event, for the first motion \( e' \) is final-oriented and disqualifies \( e \) as whole to be initial-oriented. This is why her- cannot obey the requirement of the gehen-head.

4 herum-\( \alpha \)

In order to investigate whether herum- double particle constructions can be reconstructed as built according to the principles we have formulated, we must present the semantic contribution of um. The matter is not as straightforward as with the other particles, because there are two homonymous particles um in German. um\(_1\) contributes a center and a sequence of paths around that center following tangents of the center; a second um\(_2\) contributes opposites of some kind, in particular opposite directions. Herum is composed of her- and um\(_1\). Think of a wheel with a center and spokes. Um den Baum herumfahren (to drive around the tree) describes a sequence of motions as follows: the
German

The tree is the center; there are (fictive) spokes going into that center. A path specified by *um*₁ can be modeled as a sequence of rectilinear paths 'hopping from spike to spike', so to speak, (like on the rim of the wheel).¹² As mentioned in the introduction there is a reading where *herumfahren* means aimlessly driving, which is a pragmatic effect of iteration. But there is a more basic interpretation speaking of driving around a center \( z \); the latter can be made explicit in an adjoined PP, where the internal argument of the preposition *um*₁ is the center \( z \) of the particle *um*₁, s. (11). I am concerned with the non-iterative event description which denotes a complex sequence of motions on the rim of the wheel around the center, contributed by the description of the tree in (11).

\[
\text{(11) Der Mann fuhr um den Baum herum. ‘the man drove around the tree’}.
\]

It is important for our investigation to reconstruct the surplus which *herum*- adds to the description compared to *der Mann fuhr um den Baum* (the man drove around the tree) or *der Mann umfuhr den Baum* (the man avoided the tree). I have found that surplus of *herum* described in a Grammar in terms of ‘coming back’ in Heyse (1838), p. 843 and people I ask tend to speak in these terms of the differences. In the light of our hypothesis of the primacy of orthogonality in spatial descriptions I will have achieved my purpose if I can make sense of the idea that the complex verb involves change of direction to counter-direction as part of the predication; — not like with *hin- und her* (compare Figure 1.b), but with one more change in between. Please compare Figure 2 and Figure 3. (\( r₀ \) — \( r₂ \) display points ’on the spokes’ of *um*₁ and the arrows motions ’from spoke to spoke’.)

Figure 2 is a model for *um den Baum fahren* (also for *den Baum umfahren*) but not for *um den Baum herumfahren*. Figure 3 is a model for all three verbal descriptions. Please read the two non-dotted arrows in Figure 2 as contributed by *um*₁ in a double particle construction (where the double particle modifies a motion verb like *fahren*).

According to standard morphological assumptions *um*₁ is the head of the double particle *herum* and *her*- is the non-head. According to ORH the requirements of *her*- must be justified with respect to the requirements of *um*₁, displayed here as the two motions \( e₁ \) and \( e₂ \), the first going from \( r₀ \) to \( r₁ \) and the second from \( r₁ \) to \( r₂ \). The reference point in the front of the motion required by *her* (which I refer to as \( r’₀ \)) can be resolved as the source reference point \( r₀ \) contributed by *um*₁. But the motion \( e’ \) in the front of which

---

¹²In constructions with *um*₂ as in *umherfahren* the different directions follow different spokes. There are differences in meaning between *umherfahren* and *herumfahren* which can be reconstructed in the present account. The decisive factors are (i) the difference of *um*₁ and *um*₂ in the ’wheel model’, (ii) the differentiation of head vs. non-head in the double particle: *um* is the head in *herum, her in umher*. I leave the reconstruction for another occasion.
r’₀ is required to be located cannot be resolved in the context of um₁ as either e₁ or e₂ provided by um₁, because r’₀ = r₀ is neither in the front of e₁ nor in the front of e₂ and therefore doesn’t qualify as being in the front of the sequence e₁ ⊕ e₂. As a consequence e’ has to be accommodated as a further motion e’ with r₂ at its source and thereby in the rear of e’. As a result of this accommodation the requirement of her is resolved, because r’₀ = r₀ is now in the front of e’ and thereby in the front of the sequence e₁ ⊕ e₂ ⊕ e’ which specifies the complex herumrennen-event, as displayed in Figure 3.

5 Conclusion

The semantic analyses in this paper present partial but positive answers to the general research questions concerning context dependency and compositionality:

- Can the contextual requirements of complex predicates be reconstructed as built up from the contextual requirements of their sublexical parts in a rule based manner?

- Can we model motion descriptions and change-of-motion-descriptions on the basis of a simple geometry recurring to rectilinear motion and the primacy of orthogonality?

- Can we model the interaction of the situational and attitudinal dimensions of indexicals in a unique DRT-based semantics-construction algorithm?

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References


On Reading-Dependent Licensing of Strong Negative Polarity Items

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Abstract
I address two sets of data in which the acceptability of strong negative polarity items (lift a finger, so much as) is reading dependent: (i) Strong NPIs may occur in sentences with a law-like interpretation but not in sentences with an episodic interpretation. (ii) They improve in the restrictor of a proportional determiner even if ungrammatical in the restrictor of a corresponding cardinal determiner. These data are problematic for entailment-based and pragmatic approaches to NPI licensing. I propose an account based on Discourse Representation Theory (DRT). The differences are captured using DRT’s representation of proportional determiners as duplex conditions and by the explicit integration of presuppositions into semantic representations.

1 Introduction

Negative Polarity Items (NPI) are expressions that cannot occur in affirmative, declarative sentences, but typically occur in negated sentences or in the complement clause to a matrix sentence of the form I don’t think. This is illustrated in (1-a)/(2-a) and (1-b)/(2-b). NPIs are not a homogeneous class. As shown in (1-c) and (2-c), only some NPIs can be used in the scope of not every N. I use this as a diagnostic environment in the present paper to distinguish between weak NPIs, which can occur in the scope of not every N, (see (1-c)) and strong NPIs, as in (2-c), which have a more restricted occurrence pattern. This distinction was drawn for example in (Zwarts, 1997).

(1) Occurrence pattern of weak NPIs:
   a. *Pat has ever heard of Hegel.
   b. I don’t think that Pat has ever heard of Hegel.
   c. Not every German has ever heard of Hegel.
Occurrence pattern of strong NPIs:

a. *Pat lifted a finger to help me.

b. I don’t think that Pat lifts a finger to help me.

c. *Not every students lifts a finger to help his neighbor.

In the present paper I will consider another type of environments, the restrictor of a universal quantifier and the antecedent of a conditional. According to the classification of NPI-licensing contexts in (Zwarts, 1997), both strong and weak NPIs should be possible in the restrictor of every. Similarly, both types of NPIs have been observed in the antecedent of conditionals. This is illustrated with the data in (3) and (4).

Weak NPIs:

a. [Every restaurant that is ever mentioned in the Cosmopolitan] should be shut down.

b. [If a restaurant was ever mentioned in the Cosmopolitan], it should be shut down.

Strong NPIs:

a. [Every restaurant that charges so much as a dime for iceberg lettuce] should be shut down.

b. [If a restaurant charges so much as a dime for iceberg lettuce], it should be shut down.

I will argue that strong NPIs are only possible in these contexts under a particular reading. I will, then, extend the observations made for every to the restrictor of other quantifiers. The data are presented in Section 2. This is followed by a brief discussion of previous approaches in Section 3. Sections 4 contains the basis of my representational account of NPI licensing. In Sections 5 and 6 this approach is generalized to account for the data of Section 2.

2 Data

2.1 Strong NPIs in Law-like Sentences

The status of NPIs in the contexts in (3) and (4) had been under discussion since Heim (1984). Addressing the data in (4), Heim suggests that a strong NPI is possible in the restrictor of every only in cases where there is an inherent connection between the restrictor and the scope of the quantifier — or the antecedent and the consequent in a conditional. I will call this type of sentences law-like.

The acceptable sentences in (4) are in contrast with the unacceptable occurrences of strong NPIs in (5). In (5) the relation between the two parts of the sentence is accidental, i.e. it is an observed co-occurrence of the events of the two parts of the sentence which is not based on an inherent link between the two. I will refer to this type of sentences as episodic.
(5) Strong NPIs in ‘episodic’ statements:
   a. *?\[Every restaurant that charges so much as a dime for iceberg lettuce\] happens to have four stars in the handbook.
   b. *?\[If a restaurant charges so much as a dime for iceberg lettuce\], it has four stars in the handbook.

Israel (1995) argues in detail that the difference between law-like and episodic statements has no parallel with weak NPIs. The data in (3) showed that weak NPIs are felicitous in law-like statements. The examples in (6) illustrate that they are equally fine in episodic statements.

(6) Weak NPIs in ‘episodic’ statements:
   a. \[Every restaurant that was ever mentioned in the Cosmopolitan\] happens to have four stars in the handbook.
   b. \[If a restaurant was ever mentioned in the Cosmopolitan\], it happens to have four stars in the handbook.

This brief review of Heim’s and Israel’s observations shows that even though the restrictor of universals and the antecedent of a conditional may host both weak and strong NPIs, strong NPIs are only possible in one reading. This can be captured in the following empirical generalization.

(7) Empirical generalization 1: Strong NPIs can occur in ‘law-like’ statements with every and if-clauses, but not in episodic statements.

2.2 NPIs in the Restrictor

In Section 2.1 we looked at the occurrence of strong NPIs in the restrictor of every. While the literature on NPIs concentrates on NPIs in the scope of various quantifiers, the restrictor has not received that much attention. The examples in (8) illustrate the occurrence pattern of NPIs in the restrictor of quantifiers as discussed for example in Zwarts (1997). There it is observed that the restrictor of \(\text{no, every, and few}\) allows for NPIs, whereas NPIs are excluded in the restrictor of \(\text{some, many, and most}\).

(8) a. Determiners that allow for NPIs in their restrictor:
   (i) \(\text{not every: } [\text{No/ every student who has ever studied syntax}]\) will forget this example.
   (ii) \(\text{few: } [\text{Few students who have ever studied syntax}]\) will forget this example.

b. Determiners that don’t allow for NPIs in their restrictor:
   \(\text{some/ many/ most: } [\text{Some/ Many/ Most students who have ever studied syntax}]\) analyzed this sentence correctly.

It was shown in Israel (1995) and Israel (2004) that the licensing pattern in (8) does not reflect the full picture. Israel observes a contrast between the NPI licensing in the restrictor of unstressed and stressed \(\text{some and many}\), for which he writes \(\text{sm} / \text{mn}\) and \(\text{s\'om} / \text{m\'an}\) respectively. While NPIs are excluded in the restrictor of the unstressed
versions, even strong NPIs considerably improve if the stressed version is used instead. This is shown with Israel’s examples in (9).

(9) a. *[Sm/ mny of the guests who ate so much as a bite of trout] got sick.
   b. ?[Sôme/ Mány of the guests who ate so much as a bite of trout] got sick.

This contrast can be related to observations from Partee (1988) where unstressed *sm and many are classified as weak determiners, whereas stressed söme and mány are considered strong determiners. The weak-strong distinction of determiners goes back to Milsark (1977). The existential there construction can be used as a diagnostics whether a determiner is weak or strong: Only weak determiners are allowed in this construction. This is illustrated in (10).

(10) Diagnostic environment: Existential there-sentences
   a. Weak determiners:
      There is a solution to this problem.
      There are sm/ mny/ several/ a few books on this topic.
      There are no ghosts/ few books on this topic.
   b. Strong determiners:
      * There is every book on this topic.
      * There are söme/ mány/ most books on this topic.

The classes of determiners identified by distributional criteria such as existential there sentences pattern with the semantic distinction between cardinal and proportional determiners (Barwise and Cooper, 1981). A determiner $D$ is cardinal iff the interpretation of $D(A)(B)$ depends only on the size of the set $A \cap B$. A determiner $D$ is proportional iff the interpretation of $D(A)(B)$ depends on the size of the set $A$ in addition. For illustration, consider the definitions for the cardinal determiner several and the proportional determiner most in (11).

(11) a. for each sets $A, B$, several($A$)(B) is true iff $|A \cap B| \geq 2$.
   b. for each sets $A, B$, most($A$)(B) is true iff $|A \cap B| \geq 0.5|A|$.

It is an important observation of Israel that the cardinal/proportional distinction plays a role in NPI licensing. This can be shown with the data in (12), which repeats the contrast between *sm and söme in (9), but uses unambiguously cardinal and proportional determiners.

(12) a. Cardinal determiners and NPI licensing:
      * [Several guests who ate so much as a bite of trout] got sick.
   b. Proportional determiners and NPI licensing:
      ? [Most (of the) guests who ate so much as a bite of trout] got sick.

The data from this subsection can be summarized in the empirical generalization in (13).

(13) Empirical generalization 2: Strong NPIs are (marginally) acceptable in the restrictor of proportional quantifiers.
3 Previous Approaches

In this section I will briefly sketch that prominent approaches to NPI licensing cannot capture the empirical generalizations from (7) and (13).

3.1 Entailment-based Approaches

The entailment-based approach to NPI licensing is formulated for example in Ladusaw (1980) and refined in Zwarts (1997). The key idea is that the entailment behavior of the context determines whether an NPI is possible or not. NPIs must occur in the scope of a downward-entailing operator, strong NPIs are furthermore required to be in the scope of an anti-additive operator. The relevant inference patterns are defined in (14).

(14) a. An operator $O$ is downward entailing iff for each sets $A$ and $B$, $O(A \cup B)$ implies $O(A) \cap O(B)$.

b. An operator $O$ is anti-additive iff for each sets $A$ and $B$, $O(A \cup B)$ is equivalent to $O(A) \cap O(B)$.

Applying these definitions to our examples, it can be shown that the restrictor of every is anti-additive.

(15) Every student who studies English or French knows Latin.
$↔$ Every student who studies English knows Latin and every student who studies French knows Latin.

The entailment-based approach also correctly predicts the licensing pattern in (8) as the determiners in (8-a) are all downward entailing in their restrictor, whereas those in (8-b) are not.

While the core data of NPI licensing are covered in this approach, the reading-dependent effects cannot be captured. The reason for this is that the entailment behavior does not seem to change according to the reading. For example, the entailment pattern in (15) is true independently of whether the sentences are interpreted in a law-like fashion or as an episodic observation about the current students. Similarly, the restrictor of some and many is not downward entailing, independent of whether they are used as a weak or strong determiner. The same is true for most, which is not downward-entailing in its restrictor either. This shows that the entailment-based approach cannot handle the observed reading-dependency of NPI licensing.\(^1\)

\(^1\)In a variant of the entailment-based approach, Giannakidou (1998) assumes that NPIs must be in the scope of a nonveridical operator. She defines nonveridicality for a determiner in such a way that $D(A)B$ is nonveridical in the restrictor iff the set $A$ is not presupposed. Since strong determiners usually trigger an existential presupposition on their restrictor set (Geurts, 2007), it would be expected that NPIs are even worse in the restrictor of proportional determiners than they are in the restrictor of cardinals. In Section 6 I will assume that the existential presupposition of proportional determiners is suspended in law-like statements. Under this assumption, the restrictor of proportional determiners is a nonveridical context and, consequently, NPIs should be expected there. While this approach may account for the occurrence of NPIs in the restrictor of proportional determiners in law-like statements, there remains a problem. Since nonveridicality is the weakest occurrence condition for NPIs, this account would be forced to allow strong NPIs in nonveridical contexts in general, which may lead to a serious overgeneration.
3.2 Pragmatic Approaches

My main source of data in Section 2 were the publications by Michael Israel. Israel pursues a pragmatic account of NPI licensing, based on scalar implicatures, where the relevant scales may be provided by the context. According to Israel (2004) an NPI is possible in the restrictor of most just in case there is a contextually supported inference from sets to subsets, i.e. a pragmatic inference that behaves like downward entailment. Israel illustrates this with a scenario, in which everyone who can solve the hard puzzles can also solve the easy puzzles.

(16) Scenario: for each $x$: $x$ solves hard puzzles $\rightarrow x$ solves easy puzzles
   a. inference from set to subset (similar to downward entailment):
      [Most students who could solve the easy puzzles] got a prize.
      $\rightarrow$ [Most students who could solve the hard puzzles] got a prize.
   b. inference from set to superset (similar to upward entailment):
      [Most students who could solve the hard puzzles] had trouble on the exam.
      $\rightarrow$ [Most students who could solve the easy puzzles] had trouble on the exam.

   Using this scenario, Israel (2004) shows that the NPI even is only compatible with a context in which an inference from sets to subsets is intended, i.e. an inference as in (16-a).

(17) NPI-licensing pattern from Israel (2004):
   a. Most students who could solve even a single puzzle got a prize.
   b. *Most students who could solve even a single puzzle had trouble on the exam.

   While Israel’s observation is extremely interesting, the data in (17) seem to be due to the special scalar behavior of even rather than common to NPIs in general. The examples in (18) show that the NPI ever is equally fine in both contexts from (17).

(18) NPI-licensing pattern:
   a. Most students who could ever solve a single puzzle got a prize.
   b. Most students who could ever solve a single puzzle had trouble on the exam.

   However, if we change the proportional determiner most into a cardinal determiner as in (19-a), an NPI may not occur in the sentence. Note that the sentence is such that in the given scenario, the contextual inference from sets to subsets is possible, as indicated in (19-b).

(19) a. *[Several students who could ever solve the easy puzzle] got a price.
    b. [Several students who could solve the easy p.] got a price.
       $\rightarrow$ [Several students who could solve the hard p.] got a price.
These examples illustrate that it is the cardinal-proportional distinction that is important for the NPI licensing in the restrictor of a determiner, not the direction of pragmatically available inferences.

4 A DRT-based Account of NPI Licensing

In this section I will present the basics of a DRT-based account of NPI licensing. The version of the account presented here is a minor simplification of the theory sketched in Sailer (2007a) and Sailer (2007b). Each sentence has a semantic representation that is a Discourse Representation Structure (DRS) as defined in Kamp and Reyle (1993). For NPIs I assume the general occurrence constraint in (20).

(20) In the semantic representation of a sentence, the contribution of every NPI must be part of an NPI-licensing DRS.

The constraint in (20) uses the notion of an NPI-licensing DRS, which needs to be defined. In the course of this and the next section, I will widen the definition of an NPI-licensing DRS step by step. In a first attempt, in (21), the scope of a negated DRS condition is an NPI-licensing DRS.

(21) NPI-Licensing DRS (first version): A DRS $K$ is an NPI-licensing DRS iff $K$ occurs in a DRS-condition of the form $\neg K$

This definition covers the occurrence of NPIs in sentences with a negated auxiliary and in the scope of negative indefinites such as no one. This is shown in the two examples in (22). The contribution of the NPI is underlined. In both cases it is the introduction of a discourse referent, written as $x$. The contribution of the NPI occurs in the universe of the DRS that follows the negation symbol. Since this is a NPI-licensing DRS, the constraint in (20) is satisfied.

(22) Pat doesn’t know any German city. No one knows any Swabian city.

\[
\begin{array}{c}
\neg x \\
\text{Germ-city}(x) \\
\text{know}(\text{pat},x)
\end{array}
\begin{array}{c}
\neg y, x \\
\text{person}(y) \\
\text{Swabian-city}(x) \\
\text{know}(y,x)
\end{array}
\]

In DRT, a condition of the form $\neg K$ is equivalent to an implicational condition of the form $K \Rightarrow \text{false}$, where false is any inconsistent DRS. To account for the occurrence of NPIs in the restrictor of a universal quantifier and in the antecedent of a conditional, it is sufficient to generalize the definition of an NPI-licensing DRS to the first DRS in an implicational condition. This leads to (23).

(23) NPI-Licensing DRS (second version): A DRS $K$ is an NPI-licensing DRS iff $K$ is the first DRS in a DRS-condition of the form $K \Rightarrow K'$.
The NPI licensing in \textit{if}-clauses and in the restrictor of \textit{every} follows immediately from (23). This is illustrated in (24) and (25). In both cases, the contribution of the NPI $(x)$ occurs in the first DRS of the duplex condition.

(24) \textbf{[If} Pat knows any German city\textbf{], Pat knows Stuttgart.}

\begin{center}
\begin{tabular}{|c|c|}
\hline
$x$ & $\text{Germ-city}(x)$ \\
\hline
know(pat,$x$) & $\Rightarrow$ know(pat,stuttgart) \\
\hline
\end{tabular}
\end{center}

(25) \textbf{[Everyone who knows any German city], knows Stuttgart.}

\begin{center}
\begin{tabular}{|c|c|}
\hline
$y,x$ & $\text{Germ-city}(x)$ \\
\hline
know(y,$x$) & $\Rightarrow$ know(y,stuttgart) \\
\hline
\end{tabular}
\end{center}

The representational theory of NPI licensing can be refined to account for the contrast between strong and weak NPIs. I assume that strong NPIs must be immediately contained in their licensing DRS, whereas weak NPIs allow for at most one intervening DRS. An intervening DRS is understood as a DRS that is contained in the same licensing DRS as the NPI and accessible from the NPI. These special constraints on strong and weak NPIs are stated in (26).

(26) a. A strong NPI must be an immediate part of an NPI-licensing DRS.

b. For a weak NPI, there may be at most one accessible DRS between the NPI and the NPI-licensing DRS.\footnote{In Sailer (2007a) I provide a more detailed characterization of the kinds of DRSs that may “intervene” between an NPI and its licensing DRS. For the present paper, the characterization in (26-b) is sufficient. Note also that the formulation “at most one . . . ” in (26-b) accounts for intervention effects, i.e. there may not be an additional quantifier occurring between the licensing DRS and the NPI. See Sailer (2007a,b) for details.}

In all examples that we considered so far, the NPI was an immediate part of the licensing DRS. Consequently, both weak and strong NPIs are predicted to occur in these contexts.

The constraints in (26) can be illustrated with NPIs in the scope of \textit{not every}, which I used as an empirical diagnostics in (1) and (2). In (27) a weak NPI, \textit{any} with the semantic contribution $y$, occurs in the scope of \textit{not every}. The NPI-licensing DRS is the DRS immediately following the negation sign. Within this DRS, the restrictor of \textit{every} is accessible from the DRS that contains the NPI. This shows that the constraint on weak NPIs in (26-b) is still met.
(27) **Not every student solved any problem.**

\[
\neg \quad \text{student}(x) \Rightarrow \text{solve}(x, y)
\]

In the corresponding example with a strong NPI in (28) the NPI is not licensed. Since *lift a finger* is a strong NPI, its contribution, *lift-finger*, is required to be immediately contained in the NPI-licensing DRS, which is not the case.

(28) **Not every student lifted a finger.**

\[
\neg \quad \text{student}(x) \Rightarrow \text{lift-finger}(x)
\]

5 Generalization to Proportional Determiners

After these preliminaries, I will turn to the data from Section 2.2. Partee (1988) argues that DRT is ideally equipped to account for the difference between weak and strong determiners. She proposes that strong, i.e. proportional, determiners should be treated in terms of duplex conditions, which is parallel to the treatment of *every*. In contrast to this, weak, i.e. cardinal, determiners are to be analyzed parallel to indefinites. This is illustrated for the two readings of *many* in (29) and (30), where \( k \) is a contextually specified parameter for what should count as many.

(29) Many/ Mány students like syntax. (proportional reading)

\[
\text{many}_k \quad \text{student}(x) \quad \text{like-syntax}(x)
\]

(30) Many/ Mny students like syntax. (cardinal reading)

\[
X = \sum x \quad \text{student}(x)
\]

\(|X| \geq k\)

\(\text{get-sick}(X)\)
If we adopt Partee’s suggestion of a representational difference between cardinal and proportional determiners, this can be exploited directly to generalize the definition of an NPI-licensing DRS even further.

(31) NPI-licensing DRS (final version): A DRS $K$ is an NPI-licensing DRS iff $K$ is the first DRS in a duplex condition.

With the definition in (31) we immediately derive the prediction that NPIs, both weak and strong, should be possible in the restrictor of proportional determiners but not in that of cardinal determiners. Only in the first case are they included in an NPI-licensing DRS. This is illustrated for proportional *most* in (32) and for cardinal *several* in (33)

(32) ![Diagram](image1)

(33) ![Diagram](image2)

The proposed widening of what counts as an NPI-licensing DRS immediately captures the contrast between cardinal and proportional determiners. The generalization in (13), follows naturally with standard assumptions on DRSs.

6 Presuppositions

In the proceeding section, I only focused on the cardinal/proportional distinction and ignored the law-like/episodic contrast from Section 2.1. As a consequence, my account would allow for NPIs in both law-like and episodic statements. In the present section, I will use DRT’s integrated treatment of presupposition to prevent this overgeneration. Kamp (2001) presents an architecture of DRT that includes presuppositions. He assumes that a sentence has a *preliminary representation* and a *resolved representation*. The preliminary representation is a pair whose first element is a set of presupposed DRSs and whose second element is the DRS representing the asserted content of the sentence. In a resolved representation, the presuppositions are integrated into the asserted content.

Horn (1997) argues that the difference between episodic (his *empirical*) and law-like statements can be related to a difference in presupposition. According to Horn, the
restrictor set is presupposed in an episodic universal statement. Such a presupposition is absent from a law-like statement. Adopting this plausible assumption, we arrive at distinct preliminary representations for law-like and episodic universal statements. In the law-like statement in (34) the set of presuppositions is empty. In the corresponding episodic statement in (35) it contains the restrictor DRS.

(34) Law-like statement: Every criminal will be imprisoned.

\[
\langle \{ \} , \begin{array}{c}
  x \\
  \text{criminal}(x)
\end{array} \Rightarrow \begin{array}{c}
  \text{be-imprisoned}(x)
\end{array} \rangle
\]

(35) Episodic statement: Every criminal was imprisoned.

\[
\langle \{ x \text{criminal}(x) \} , \begin{array}{c}
  x \\
  \text{criminal}(x)
\end{array} \Rightarrow \begin{array}{c}
  \text{be-imprisoned}(x)
\end{array} \rangle
\]

Given that there are distinct representations for law-like and episodic statements, it is possible to fine-tune the representational theory of NPI licensing accordingly. In the following, I assume that NPI licensing is checked at the level of the preliminary representation.

The inclusion of presupposition into the preliminary DRSs of a sentence has as its consequence that some parts of the contributed semantic material may occur more than once in the representation. In (35) the DRS that represents the restrictor of every occurs twice: Once in the asserted content, once in the set of presupposed DRSs. So far, my theory of NPI licensing does not specify whether both of these occurrences need to be licensed. I propose to distinguish two kinds of NPIs, which I will call presupposition-sensitive NPIs and presupposition-neutral NPIs. The relevant constraints on these types are given in (36).

(36) a. Every occurrence of a presupposition-sensitive NPI in the preliminary representation must be licensed.

b. Every occurrence of a presupposition-neutral NPI in the asserted part of the preliminary representation must be licensed.

The data in Section 2.1 suggests that in English, weak NPIs are typically presupposition-neutral, whereas the listed strong NPIs are presupposition-sensitive. With this assumption, the ban of strong NPIs from episodic universal statements and conditionals can be captured. Consider first the grammatical, law-like statement in (37) and its DRS. Being a law-like statement, the restrictor of the universal is not presupposed. Therefore, there is only one occurrence of the strong NPI, drink-drop, in the DRS. This occurrence is in the first box of a duplex condition. Consequently, it is immediately contained in an NPI-licensing DRS, and the constraints in (26-a) and (36-a) are satisfied.
(37)  **[Every driver who drinks a drop] should lose his license.**

\[
\{ \{ x \mid \text{driver}(x) \land \text{drink-drop}(x) \} \Rightarrow \text{loose-lic}(x) \} ,
\]

The DRS of the corresponding episodic statement is given in (38). As far as the asserted content is concerned, the structure is as in (37) above. However, since the statement is episodic, the restrictor of the universal is included in the set of presupposed DRSs. As a consequence, the semantic contribution of the NPI occurs among the presuppositions as well. Since the NPI is presupposition sensitive, its occurrence in the presupposition set needs to be licensed. But in this set, the DRS that contains the NPI is not an NPI-licensing DRS. From this, it follows that the occurrence of the NPI violates (36-a) and, therefore, is not felicitous.

(38)  *[Every driver who drank a drop last night] caused an accident.

\[
\{ \{ x \mid \text{driver}(x) \land \text{drink-drop}(x) \} , \{ x \mid \text{driver}(x) \land \text{drink-drop}(x) \} \Rightarrow \text{cause-acc}(x) \} ,
\]

Combining the insights from this and the previous section, we can see why the use of strong NPIs in the restrictor of proportional determiners is usually degraded. The existential impact of the restrictor set tends to be strong for proportional determiners. Only in limited occasions is it possible to arrive at a law-like, i.e. non-presuppositional, reading with a determiner such as *most*. This is exactly confirmed by the observations in Israel (1995) that the law-like/episodic dichotomy is not only relevant for NPIs in the restrictor of universals but extends to proportional determiners in general. I quote Israel’s data that illustrate this contrast in (39).

(39)  **[Most students who’ve read the least bit of poetry], . . .

a. will be familiar with Steven’s “The Emperor of Ice Cream”.

b. ?*seem to wear hats.**

The present theory accounts for this contrast in the same way it accounted for the difference between (37) and (38). In both version of the sentence in (39) the strong and presupposition-sensitive NPI *the least bit* is licensed in the asserted part of the DRS. In the episodic reading in (39-b), however, the NPI fails to be licensed in the presupposed part.

As pointed out to me by Regine Eckardt (p.c.) the present proposal also correctly predicts that strong NPIs are usually excluded in the restrictor of *none of the N*, even though they are freely possible in the restrictor of *no N*. This is shown in (40). The important difference is that *none of the N* is presuppositional.

(40)  **[Most students who’ve read the least bit of poetry], . . .

a. will be familiar with Steven’s “The Emperor of Ice Cream”.

b. ?*seem to wear hats.**
(40) a. *None of the [students who've read the least bit of poetry] seems to wear a hat.
b. No one [who was paying the least bit of attention] forgot this poem.

7 Conclusion

The paper is based on often-neglected data on the occurrence of strong NPIs in the restrictor of proportional determiners and in the antecedent of conditionals. I showed that an account of the facts is possible that uses standard DRT structures for the sentences. I made use of two important properties of DRT: First, proportional and cardinal determiners can be represented in structurally distinct ways. Second, with the integration of presuppositions into the DRS of a sentence, DRT provides just enough pragmatics inside the semantic representations to capture the contrast between law-like and episodic statements.

I classified NPIs in two dimensions: First, in (26), according to the allowed distance between the NPI and its licensing DRS, and second, in (36), with respect to their sensitivity to presuppositions. I consider it an open question whether these dimensions should be unified. The data in Giannakidou (2006) suggest that the two dimensions may, indeed, vary independently of each other. Her characterization of the distribution of certain Greek NPIs suggests that they may be licensed in weak licensing contexts such as in the scope of few, but that they show presupposition-sensitivity. Since Giannakidou’s theory is cast in different terms, it is not clear whether the behaviour of Greek NPIs can be captured in the way I just sketched. More detailed and cross-linguistic data needs to be taken into account to settle this question.

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References


Vagueness in Degree Constructions

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Abstract
This paper presents a novel semantic analysis of unit names and gradable adjectives, inspired by measurement theory (Krantz et al 1971). Based on measurement theory's typology of measures, I claim that different predicates are associated with different types of measures whose special characteristics, together with features of the relations denoted by unit names, explain the puzzling limited distribution of measure phrases.

1 Introduction: Measurement theory in grammar

1.1 The aims and structure of this paper

Measures can be described as mappings of individuals to degrees along dimensions (height, width, loudness, etc.; cf., Krantz et al, 1971). My main claim in this paper is that the grammar of natural language is sensitive to the distinctions of measurement theory's taxonomy of measure types. This four level taxonomy goes back to Stevens (1946), who dubbed the by now widely used names for the four measure types – ratio-scale measures (also known as extensive measures), interval-scale, ordinal-scale and nominal-scale measures. Measurement theory was not only found useful in the analysis of the correct use of measurement in natural sciences such as physics. Its taxonomy is extensively used in statistics and its application for research methods in the social sciences (Babbie, 2004). It is also an important source of influence in the field of psychophysics, where it is found useful in describing the way subjects perceive and represent scalar properties of stimuli, ranging from properties such as sound, color, and weight to scales of, for instance, pain, well-being and even grammaticality judgments (Featherstone, to appear).

In order to demonstrate that grammar is sensitive to measurement theory's distinctions, in this paper I address problems pertaining to the interpretation and distribution of unit names, like pound and meter, that form measure phrases (as in two pounds). Measure phrases occur in constructions like two meters tall (‘numerical
degree predicates'), as well as two pounds of cheese ('classifier constructions'). I focus on the former structure, whose distribution is highly restricted.

Numerical degree phrases are not used with most predicates (happy, beautiful, intelligent, etc.) or nominalizations (happiness, beauty, intelligence, etc.), including adjectives for which conventional measuring systems exist (as the infelicity of #two degrees warm, #two dollars expensive and #two kilos heavy illustrates; Kennedy 2001; Schwarzschild, 2005). While in some languages, numerical degree modifiers are allowed with a restricted set of positive predicates (e.g., English), in other languages (like Hebrew), numerical degree modifiers are allowed with a restricted set of nominalizations (as in gova (shel) shney meter 'height (of) two meters'). In addition, the set of positive predicates, which indeed allows this modification, varies considerably between languages (Schwarzschild, 2005). Despite this limited distribution, in many languages, measure phrases do occur freely in the comparative form of all predicates (as in two meters taller/shorter; two degrees warmer; two kilos heavier, etc.), and speakers often creatively produce new numerical degree constructions, such as two heads taller, two fingers wide(r) and two aspirins sick(er) (I thank Louise McNally for this last example).

The licensing of ratio modifiers like twice is related in intricate ways to that of measure phrases. Ratio modifiers are most acceptable and most often used with positive adjectives that license measure phrases, as in, for instance, Dan is twice as tall as Sam. Negative adjectives in the positive form, combine neither with measure phrases (cf. #Dan is two meters short), nor with ratio modifiers (cf. #Dan is twice as short as Sam). However, many positive adjectives (like happy), which resemble negative ones in not licensing measure phrases, are acceptable with twice (e.g., I am twice as happy as I used to be is not as bad as, e.g., #Dan is twice as short as Sam). In fact, speakers use twice more often with happy than with short. In a study of Google-search results, the proportion of ratio constructions ('twice as Adj. as') out of the total amount of equative constructions ('as Adj. as') was more than five times greater with happy (15%) than with short (~3%; Sassoon 2008, Table 1).

In part 1, I present the relevant taxonomy of measurements. In part 2, I present a new analysis of unit names and measure phrases, which is directly inspired by measurement theory (cf. Krantz et al, 1971; Klein, 1991). In part 3, I explore the consequences of this analysis. I show that different gradable predicates are associated with different types of measures, whose special characteristics, together with features of the relations denoted by unit names, explain the limited distribution of measure phrases.

### 1.2 Measurement types in measurement theory

I propose that in addressing grammatical facts pertaining to measurement, gradability and comparison, it is useful to consider the following classification of scalar properties or degree functions (assignments of numbers to objects along a dimension; Stevens 1946; Krantz et al 1971; see also Wikipedia, the free Encyclopedia under 'Level of measurement').
The first level in this classification is called *nominal*. The only significance of nominal degree functions lies in the fact that entities are assigned the same or different values. If the values are numerals, the choice of numerals is irrelevant and the only comparisons to be made between variable values are equality and inequality. There are no "less than" or "greater than" relations among the values, nor operations such as addition or subtraction. Examples are the set of eye colors (brown, blue, green, etc.) and the set of truth values \{0,1\}.

The second level is called *ordinal*. Here, the numbers assigned to objects represent their rank order (1st, 2nd, 3rd etc.). Comparisons of "greater than" and "less than" can be made, in addition to equality and inequality. However, operations such as addition and subtraction are still meaningless. Examples include the results of a horse race or a swimming competition, which state only which competitors arrived first, second, third, etc. but do not state time intervals.

The third level is called *interval*, where, in addition to the features of an ordinal level, equal differences between values represent equivalent intervals. Thus, operations such as subtraction are meaningful. But the zero point on the scale is arbitrary and negative values can be used. Thus, neither sums of nor ratios between numbers on the scale are meaningful, and operations such as multiplication, division and addition cannot be carried out directly (only ratios of differences between pairs of values can be expressed; one difference can be twice the other, etc., as demonstrated in Section 3.3). Examples are the year date in many calendars and temperature in the Celsius or Fahrenheit scale. The fact that the water freezing point is mapped to the zero Celsius degree is arbitrary (as arbitrary as the fact that the water boiling point is mapped to the 100 Celsius degree). The freezing point does not correspond to non-existence of temperature, in fact it corresponds to 273 Kelvin degrees. Accordingly, it is meaningless to say that 20 degrees Celsius is twice as hot as 10 degrees Celsius, in the sense that 20 degrees Celsius does not represent a double amount of heat (for a more complete discussion of the Celsius scale see Section 3.4).

The forth level is called *ratio*. Ratio functions have all the features of interval functions, in addition to meaningful ratios between values. Operations such as multiplication, division and addition are therefore meaningful. The zero value on a ratio scale is non-arbitrary. Most physical quantities, such as mass, length or energy are measured in ratio scales; so is temperature measured in Kelvin, that is, relative to absolute zero. Other examples include age, length of residence in a given place, etc.

Having presented measurement theory's levels of measurements, I now give my account of the semantics and distribution of unit names and measure phrases.

## 2 My Proposal

### 2.1 Vagueness pertaining to degrees

My implementation of ideas from measurement theory in the semantics of adjectives is unique in that it crucially relies on observations regarding the information that
different adjectival degree functions do or do not encode, i.e., the idea of vagueness as pertaining to degree constructions is central to the present analysis.

Let us call the linguistic and world knowledge of a given community of speakers an actual context. In standard vagueness models (van Fraassen 1969; Kamp 1975; Veltman 1984; etc.), expressions are assigned interpretation relative to information states (contexts) $c$, rather than relative to worlds $w$, so the interpretation of a statement in a context $c$ may be true, false or undetermined. Only in (and in all) contexts of total information (supervaluations; van Fraassen 1969) is the truth value of all statements determined (it is either true or false). Let $M_c$ be a vagueness model for a domain $D$ and a set $C$ of contexts. For any context $c$, let $T_c$ be the set of statements that are true in every completion $t$ of $c$, and the set of statements that are false in $c$ consist of the statements that are false in every completion $t$ of $c$. For example, the truth of a statement like it rains is considered common knowledge in a given context $c$ iff it holds true in every completion $t$ in $T_c$; the falsity of a statement is considered common knowledge in $c$ iff it is false (e.g., it does not rain) in every completion $t$ in $T_c$. The truth value of a statement is undetermined in $c$ iff $T_c$ includes both a completion in which it is true (e.g., it rains) and a completion in which it is false (it does not rain). Generally, for any statement $\varphi$:

\begin{align}
1. & \quad \|\varphi\|_c = 1 \text{ iff } \forall t \in T_c, \|\varphi\|_t = 1 \\
2. & \quad \|\varphi\|_c = 0 \text{ iff } \forall t \in T_c, \|\varphi\|_t = 0 \\
3. & \quad \text{Otherwise, } \|\varphi\|_c \text{ is undetermined}
\end{align}

Let $T$ be the set of total contexts in $C$. In this paper, I associate gradable adjectives with the following semantics:

\begin{align}
1. & \quad \text{For any } t \in T, \text{ and any gradable adjective } P:
2. & \quad a. \quad \text{Let } f_{P,t} \in \mathbb{R}_{\mathbb{D}}^T \text{ be the degree function of } P \text{ in } t \text{ (where } \mathbb{R} \text{ is the set of real numbers).}
3. & \quad b. \quad \text{Let } c_{P,t} \in \{0,1\}_{\mathbb{D}}^T \text{ be the characteristic function of } P \text{ in } t \text{ (where 1 and 0 stand for truth values).}
4. & \quad c. \quad P \text{ denotes either } f_{P,t} \text{ or } c_{P,t}, \text{ depending on the linguistic context. For example, in statements like Dan is taller than Sam, the adjective tall denotes } f_{\text{tall},t}, \text{ while in statements like Dan is tall, tall (or its projection) denotes } c_{\text{tall},t} \text{ (Kennedy, 1999).}
\end{align}

While in standard vagueness models, supervaluations represent different cutoff points for vague adjectives like tall, in the present proposal, they serve to represent different measuring conventions for gradable adjectives. For example, while in a total context $t_1$ the values of $f_{\text{tall},t_1}$ may correspond to the outcome of measuring entities' heights with a centimeter ruler (so, e.g., the meter is mapped to the number 100), in another total context $t_2$ the values of $f_{\text{tall},t_2}$ may correspond to the outcome of measuring entities' heights with an inch ruler (so, e.g., the meter is mapped to 39.4).
We need a representation of vagueness pertaining to degrees, because some information is not encoded by adjectival degree functions. In particular, ordering dimensions (height, heat, happiness, etc.) are typically mass noun interpretations, although we cannot directly count quantities of the ‘stuff’ denoted by such nouns. No given quantity of water, height, heat or happiness is unequivocally associated with a given (context-invariant) value like 1 or 2 or 345. Thus, objects d with a non-zero quantity of, e.g., height, should be mapped to different numbers in different total contexts in $T_c$ of an actual context c ($\exists t_1, t_2 \in T_c: f_{tall,t_1}(d) \neq f_{tall,t_2}(d)$).

In fact, many functions (many types of rulers, if you like) adequately represent heights. Any function that maps equally tall entities to the same number and that maps the concatenation of n equally tall entities to n times that number, is additive with respect to height, i.e. adequately represents differences and ratios between entities' heights. For example, the mapping of two equally tall entities, $d_1$ and $d_2$, and their concatenation, $d_1 \otimes_{\text{height}} d_2$, to the values 5, 5 and 10, respectively, is additive. But so is their mapping to 2,2, and 4, respectively, and so is their mapping to 100, 100 and 200, respectively, etc. Each mapping corresponds to (the outcome of measuring entities' heights with) some possible ruler (inch, centimeter, meter, etc.)

### 2.2 Information about degree ratios and the interpretation of unit names

We see that many different functions may be associated with adjectives like tall. Despite this intrinsic vagueness regarding the mapping of entities to degrees, some information is encoded by adjectival degree functions. In particular, all the functions that may be associated with adjectives like tall adequately represent height ratios. This means that they share the same ratios between degrees, e.g., since the height of $d_1 \otimes_{\text{height}} d_2$ is twice the height of $d_1$ in all the examples just given, the ratio between their degrees is the number 2 in all these examples ($2 \times 5 = 10; 2 \times 2 = 4$ and $2 \times 100 = 200$). In fact, all rulers (meter rulers, inch rulers, etc.) specify the same ratios between entities' degrees (precisely the ratios between the entities' heights). As these ratios are easily accessible to us (they are unequivocally determined numbers, identical in all the additive measuring systems), in any t, $f_{tall,t}$ should adequately represent them. Thus, in every $t \in T_c$, entities with n times d's height are mapped to the number $n \times f_{tall,t}(d)$. All tall's functions in $T_c$, then, yield the same ratios between entities' degrees (these ratios are context-invariant).\(^1\)

The moral to be drawn from the above observations is the following. It is not the case that, say, Dan is 2 meters tall is true in a context c iff in every total context t of $T_c$, $f_{tall,t}$ maps Dan to 2. In any actual context c, the value to which $f_{tall,t}$ maps Dan varies across accessible total contexts, rendering Dan's value undetermined (r $\forall t \in T_c$, $f_{tall,t}([[\text{Dan}]]_t) = n$). Rather, the truth of statements with numerical degree

---

\(^1\) Surely, degree functions of adjectives like tall map entities to numbers per a given total context and time point, and entities' height ratios are identical in every total context per a given time point. It is only for simplicity that I omit indices such as those representing time points.
predicates must be determined based on information regarding height ratios. In particular, directly based on measurement theory (cf. Klein, 1991), I propose that an entity d falls under the predicate 2 meters tall iff the ratio between d’s degree in tall and the degree in tall of the original meter stick in Paris or any other entity that is one meter tall ('a meter unit-object'), r_{m,t}, is 2:

\[
[[\text{Dan is two-meters tall}]]_c = 1 \quad \text{iff} \quad \forall T \in T_c: f_{\text{tall},d}([[\text{Dan}]]_c) = 2 \times r_{m,t}.
\]

Thus, I take unit nouns (e.g., meter) to be extensional, in the sense of being directly linked to a set of entities which, by virtue of a convention, are regarded as unit objects, e.g., the entities whose height we call 'one meter'. This set, then, does not vary across the total contexts of any given context c. For any unit name unit, let D_u \subseteq D be the set of unit objects of unit. I claim that, the word meters in statements such as Dan is two meters tall is interpreted as equivalent to the predicate "\(\lambda P, \lambda n. \lambda x. x \ is \ n \ times \ as \ P \ as \ a \ meter \ unit-object\)". In this interpretation, in every total context t, the unit name denotes (the Schonfinkelized function of) a relation between (the degree function of) an adjective P (e.g. tall, wide, long, etc.), a number n, an and entity d in D, such that d's amount of P-hood (e.g., d's height, represented numerically by the value \(f_{\text{tall},i}(d)\)) equals n times that of a meter unit-object (represented by the value \(f_{\text{unit},i}(d_{m})\), for any meter unit object \(d_{m} \in D_{m}\)). Since all unit objects are equally tall, we can represent their degree as a constant, \(r_{m,t} = \sigma(f_{\text{tall},i}(d_{m})): d_{m} \in D_{m})\), where \(\sigma\) is a function from singletons to their unique members). Thus, we can give a general interpretation rule for unit names and numerical degree predicates. Let us add to the language the category UNIT \(\subseteq\) NOUN^3 that consists of words like meter(s), gram(s), etc.:

\[
\forall t \in T, \forall P \in \text{ADJ}, \forall u \in \text{UNIT}:
\]

a. \(\exists r_{u,p} \in \mathbb{R}, r_{u,p} \neq 0: D_u = \{d \in D: f_{P,t}(d) = r_{u,p}\}\). 

b. [[\(\lambda n, \lambda x. u(P, n, x)\)]_t] = \(\lambda r \in \mathbb{R}. \lambda d \in D. \) for some \(d_{m} \in D_{m}: f_{P,t}(d) = r \times f_{P,t}(d_{m})\).

In any t, the denotation of a numerical degree predicate that is based on u and P is a relation between numbers r and objects d, such that d's degree in P equals r times the degree of any unit-object \(d_{u}\). For example, [[centimeters]]_t = \(\lambda f_{P,t} \in \mathbb{R}^{D}. \lambda r \in \mathbb{R}. \lambda d \in D. \) for some \(d_{cm} \in D_{cm}: f_{P,t}(d) = r \times f_{P,t}(d_{cm})\). Table 1 illustrates my proposal by means of a simplified model with three individuals and three total contexts. According to my proposal, we consider individuals' degrees in tall as specified because: (i) The ratios between (values representing) heights do not vary across total contexts, e.g., as the ostrich in Table 1 is twice as tall as the chicken, the ratio between the degrees of the ostrich and the chicken is 2 in every total context; (ii) A set of unit objects exists, \(D_{cm} = \{d_{cm}\}\), s.t. d is n centimeters (cm) tall iff the ratio between d’s degree and the centimeter unit objects’ degree is n, e.g., as the ratio between the degrees of the ostrich and the centimeter unit object
object is 100 in every total context in our example, *the ostrich is 100 centimeters tall* is true in it.²

Table 1: An example of my proposal

<table>
<thead>
<tr>
<th>(i) $f_{\text{tall},t}(d)$</th>
<th>$r_{\text{cm},t}$</th>
<th>(ii) $f_{\text{tall},t}(d) = n \times r_{\text{cm},t}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$d_{\text{ostrich}}$</td>
<td>$d_{\text{chicken}}$</td>
<td>$d_{\text{ostrich}}$ is 100 cm tall:</td>
</tr>
<tr>
<td>100</td>
<td>50</td>
<td>100 = $100 \times 1$</td>
</tr>
<tr>
<td>200</td>
<td>100</td>
<td>200 = $100 \times 2$</td>
</tr>
<tr>
<td>300</td>
<td>150</td>
<td>300 = $100 \times 3$</td>
</tr>
</tbody>
</table>

3 Consequences

In Part 3, I describe in detail the various consequences of the analysis just presented. I argue in detail that it captures not only the interpretation, but also the puzzling limited distribution of measure phrases. In particular, I have argued for (5):

(5) In actual contexts, speakers feel they have information about entities' degrees in *tall* only because the following two preconditions hold:

a. *Precondition (i):* The ratios between entities' degrees are context-invariant numbers ($\forall d_1, d_2 \in D, \exists n \in \mathbb{N}: \forall t \in T_e, f_{\text{tall},t}(d_1) / f_{\text{tall},t}(d_2) = n$), and

b. *Precondition (ii):* There is a consensus regarding a set of unit-objects (e.g., the meters) that serves as a reference point, so that any entity $d$ is mapped to a context-invariant number, representing the ratio between $d$'s degree and the unit objects' degree in *tall*.

In the following, I show that in languages that allow adjectives to combine with measure phrases, an adjective does not license unit names and numerical degree predicates iff at least one of these preconditions is violated.

3.1 Violations of precondition (ii): No consensus about unit-objects

My proposal predicts that the absence of conventional unit objects will result in vagueness concerning the mapping of entities to numbers. I propose that some adjectives have no unit names associated with them because it is impossible to determine a convention for them regarding a set of unit objects. Consequently, we have the impression that these adjectives do not map entities to numerical degrees.

² Some unit names (like *Celsius*) are interpreted by other interpretation rules. Yet we will see in Section 3.4 that speakers often wrongly presuppose that the unit name *Celsius* is interpreted by the above given rule (4). Thus, this rule is productively used by speakers, while other rules invented by scientists are not.
Consider, for instance, happy. Emotions are internal states. It is hard to come up with conventions as to which emotional extent should be mapped to degree 1, 2, 3, etc. Even if one speaker treats a certain internal state as a unit object, no other speaker has access to this state. So no object d can be agreed upon by all the community of speakers to constitute a unit object. This is the case even if any one of the speakers associates with happy internal (subjective and non-conventional, but nonetheless actual) means of additively measuring happiness intensities (including a suitable 'concatenation' relation for such intensities).

Similarly, while weight can be measured by kilograms, the internal states of speakers when they lift objects (their feeling of the objects being heavy, light, etc.) cannot be measured by conventionally established unit names. If a language maps a predicate to the latter type of degrees, the predicate will not license unit names and numerical degree modifiers. But this does not show that predicates do not map entities to numbers. In fact, when no unit name is explicitly mentioned, it is rather meaningless to say that something is tall to degree 456 (456 what? Kilometers? Meters? Inches?) In adjectives like happy, this is always the situation.

This proposal improves upon non-numerical theories (cf. Moltmann, 2006) because it accounts for the compatibility of happy with ratio and difference modifiers. For example, Dan is twice as happy as Sam is a claim concerning the ratios between the arguments' happiness degrees (with no reference to unit objects):

\[(6)\quad \text{[Dan is twice as happy as Sam]}_c = 1 \text{ iff } \forall t \in T_c: f_{\text{happy}, t} ([\text{Dan}]_t) = 2 \times f_{\text{happy}, t} ([\text{Sam}]_t).\]

In addition, we can present a unified analysis of comparative morphemes with and without numerical degree modifiers, whereby the interpretation of these morphemes is mediated by a difference operation, creating difference modifiers:

\[(7)\quad \begin{align*}
\text{a.} & \quad \text{[Dan is 2 meters taller than Sam]}_c = 1 \text{ iff } \\
& \quad \forall t \in T_c: f_{\text{tall}, t} ([\text{Dan}]_t) - f_{\text{tall}, t} ([\text{Sam}]_t) = 2 \times r_{\text{mt}, t}. \\
\text{b.} & \quad \text{[Dan is happier than Sam]}_c = 1 \text{ iff } \\
& \quad \forall t \in T_c, \exists r \in R, r > 0: f_{\text{happy}, t} ([\text{Dan}]_t) - f_{\text{happy}, t} ([\text{Sam}]_t) = r.
\end{align*}\]

We see that speakers do not need to know the degrees of entities they refer to, only the ordering or ratios between their degrees. These are available to them (cf., Section 2.2).

Notice that speakers often assert, for instance, that they are twice as happy, as a manner of speech – a figurative way of stating that they are much happier. However, this does not show that twice as happy is ungrammatical. Presumably, we may not be familiar nor understand the nature of any ratio-scale measuring means for happy. Still, there is no a-priori reason to think that such measurements are impossible (we do not possess information according to which perceptual and emotional measurements of our experiences must be non-ratio-scale). For this reason we do not judge utterances of expressions such as twice as happy ungrammatical, even if we do not completely understand what they mean (we will see in the next Section that this is not the case for expressions like twice as short).
Furthermore, even when speakers are willing to accommodate the presupposition that additive measuring systems exist for happiness, they cannot always be precise about degree ratios, e.g., "on Monday I was twice as happy as I was on Sunday" is a very precise conclusion to reach through introspection. Speakers may be reluctant to commit themselves to this level of precision regarding their emotions.

In sum, I propose that it is for these reasons, and not because it is ungrammatical in the literal sense, that twice as happy is used as a manner of speech. We can reason with statements like I am ten times happier now than I used to be ten years ago or I am twice as happy now as I was ten minutes ago. In fact, the 'figurative' use probably emerges by virtue of the fact that the literal sense does exist. Thus, one source for cross linguistic variation in the licensing of measure phrases with positive adjectives is formed by differences in the measure type associated with (translations of) an adjective, e.g., languages may vary as to whether predicates like heavy or warm are associated with measures of external or internal states or both. With internal measures, measure phrases are ruled out due to violations of condition (ii) (absence of conventional unit objects; cf. (5b)), i.e. regardless of whether the given adjectival measure encodes degree ratios or not.

3.2 Violations of precondition (i): No information about degree ratios

While we may acknowledge the ratios between, say, our degrees of happiness on separate occasions, we can hardly ever acknowledge the ratios between degrees of entities in predicates like short. This is illustrated by the fact that ratio modifiers are less acceptable with short (twice as short) than with tall or with long (for similar contrasts in other antonym pairs see Kennedy, 2001). Sassoon (2008) empirically supports the claim that ratio modifiers are less often used with negative adjectives (e.g., short) than with their positive antonyms (e.g., tall), based on a study of Google search-results of equative comparisons and ratio comparisons with pairs of antonym adjectives.

Accordingly, the present analysis predicts that, in the absence of a specification of (or information concerning) ratios between degrees, numerical degree predicates are not licensed, i.e. we directly explain why negative adjectives fail to combine with measure phrases to form numerical degree predicates, e.g., the infelicity of two meters short.

3.3 Measure phrases in comparison statements

Still, numerical degree predicates are acceptable in the comparative form of either positive or negative adjectives (cf. Kennedy, 1999), as illustrated by the contrast between Dan is two meters short and Dan is two meters shorter than Sam. In fact, in actual contexts, we can positively say that Dan's degree in short is n meters bigger than Sam's, iff Sam's degree in tall is n meters bigger than Dan's.
In Sassoon (2008), I show that we can predict these facts by assigning any negative adjective, in any index $t$, a degree function that linearly reverses and linearly transforms the degrees of its positive antonym. In other words, I propose that for any total context $t \in T_c$, there is a constant $\text{Tran}_{\text{short},t} \in \mathbb{R}$, such that $f_{\text{short},t}$ assigns any $d$ in $D$ the degree ($\text{Tran}_{\text{short},t} - f_{\text{fall},t}(d)$). Let me briefly motivate this proposal.

The motivation for assuming that degree-functions of negative adjectives are reversed compared to the functions of their positive antonyms is rather straightforward. This assumption represents the fact that, e.g., Dan is taller than Sam iff Sam is shorter than Dan, i.e. the ordering between the degrees assigned to any two entities by short is reversed in comparison with the ordering between the degrees assigned to them by tall.

The basic motivation for transformation values is the following (Sassoon 2008). We can positively say that an adjective like tall, which is linked to conventional additive measuring systems, maps entities with no height to zero. The outcome of measuring entities with no height, such as the surface of the floor, with a ruler (just any possible ruler) is systematically the number zero. So in every $t \in T_c$, $f_{\text{fall},t}$ maps entities with no height (abstract entities; surfaces) to 0 (it's additive). However, consider the adjective short. If, in every total context $t$ of $T$, $f_{\text{fall},t}$ is additive (it maps entities with no height to 0), and short is not transformed in a context $c$ ($\text{Tran}_{\text{short},t} = 0$ in every total context $t$ of $T_c$, i.e. $f_{\text{short},t} = -f_{\text{fall},t}$), then the degree of entities $d$ with no height in short is predicted to be 0 in $c$ (because in every $t \in T_c$ it is $-f_{\text{fall},t}(d) = -0 = 0$). But is this so? Can we positively say that short maps entities with (almost) no height, such as the surface of the floor, to (almost) zero? (or, in other words, that the surface of the floor is short to degree zero?) Not really. As tall does not have a maximum point (we cannot tell which entities are the tallest), the antonym short does not have a minimum point (a zero). Some semantic theories (cf., von Stechow, 1984b; Kennedy, 1999) endorse the view that entities with (almost) no height are mapped to (a degree that approximates) infinity (formally, they are mapped to the largest interval $(0, \infty)$, not the zero interval $(0,0)$). Therefore, in these theories, too, the degree function of short transforms height quantities by a non-zero constant. When I ask speakers to examine their intuitions regarding this issue, they are puzzled. Our intuitions about the point of 'zero shortness', so to speak, are completely blurred. I propose that this is the natural sign of an unspecified transformation value. Hence, the degree function of short transforms height quantities by a non-zero constant, $\text{Tran}_{\text{short}}$. We know nothing about this constant. It may be any number (it varies across total contexts in $T_c$), rendering the zero point undetermined ($\exists n \in \mathbb{R} \forall t \in T_c, \text{Tran}_{\text{short},t} = n$).

But if $\text{Tran}_{\text{short},t} \neq 0$, $f_{\text{short},t}$ is not additive – it does not represent ratios between entities' heights. If, e.g., $f_{\text{fall},t}(d_1)=5$, then by additivity $f_{\text{fall},t}(d_1 + \text{height}d_2)=10$. But, say, a function $f_{1\text{-}f}$ that maps each $d$ to $(1- f_{\text{fall},t}(d))$ is such that $(f_{1\text{-}f}(d_1) = f_{1\text{-}f}(d_2)=--$

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3 Additive height-functions, as opposed to transformed ones, must map entities with no height to zero (and entities with height to degrees other than zero), for otherwise they will not adequately represent height ratios. In order to see this, consider, for example, a function $f$, such that $f$ maps some entity $d_0$ with no height (say, the surface of the floor) to some number other than zero, say, $1/2$ and $f$ maps a meter unit-object to the number 1. The ratio between $d_0$'s value and the value of a meter unit-object is then the non-zero number $1/2$ (it is half a meter tall), while the ratio between $d_0$'s height and the height of a meter unit-object (or any other object) is 0. Thus, $f$ does not adequately represent height ratios.
Vagueness in Degree Constructions

4) and \( f_{tall}(d_{1(\Theta_{height}d_2)}) = 1 - f_{tall}(d_{1(\Theta_{height}d_2)} = 9 \neq (2 \times 4) \). The ratio between the degrees of \( d_{1(\Theta_{height}d_2)} \) and \( d_1 \) is 9/4, while the ratio between their heights is 8/4.

The fact that negative adjectives fail to represent ratios has consequences.

First, ratio modifiers are less acceptable when combined with negative adjectives than when combined with their positive antonyms (cf. the infelicity of, e.g., #Dan is twice as short as Sam).

Second, negative adjectives do not license unit names. The semantic value of unit names, e.g. inches, crucially relies on the fact that the function denoted by its adjectival argument P in each context of use encodes the ratios between the amounts of P-hood in entities (so to speak) and the amount of P-hood in a unit object. Thus, adjectives whose functions do not encode these ratios cannot form arguments for unit names. A unit name like inches exists for the adjective tall by virtue of the fact that the degree function of tall does encode the given ratios. Had the degree function of tall been transformed, like the degree function of short, inches would not constitute possible units for tall.

Nor can we use negative adjectives in the positive form with numerical degree phrases construed of their positive antonyms and their unit names (as in *two meters short). Why? If, for instance, in c, tall maps some d to 2 meters (\( \forall t \in T_c, f_{tall}(d) = 2 \times r_{m,t} \)), short maps d to \( \text{Tran}_{short} - 2 \) meters (\( \forall t \in T_c, f_{short}(d) = \text{Tran}_{short,t} - 2 \times r_{m,t} \)). As the transformation value of short, \( \text{Tran}_{short,t} \) varies across total contexts in \( T_c \), we cannot say which entities are 2 meters short in c (\( \neg \exists d: \forall t \in T_c, f_{short}(d) = 2 \times r_{m,t} \)).

However, in computing degree-differences, the transformation values of the two degrees cancel one another: \( \forall t \in T_c, d_2 \) is 2 meters taller than \( d_1 \) (i.e., \( f_{tall}(d_2) \)) maps \( d_2 \) to some \( n \in \mathbb{R} \) and \( d_1 \) to \( n - 2 \times r_{m,t} \); the difference between these degrees is \( 2 \times r_{m,t} \) iff \( \forall t \in T_c, d_1 \) is 2 meters shorter (i.e., \( f_{short}(d_1) \)) maps \( d_1 \) to \( \text{Tran}_{short,t} - n \) and \( d_1 \) to \( \text{Tran}_{short,t} - (n - 2 \times r_{m,t}) \); the difference between these degrees is still \( 2 \times r_{m,t} \): (\( \text{Tran}_{short,t} - (n - 2 \times r_{m,t}) \)) - (\( \text{Tran}_{short,t} - n \)) = \( \text{Tran}_{short,t} - a + 2 \times r_{m,t} - \text{Tran}_{short,t} + a \) = \( 2 \times r_{m,t} \). So the differences between degrees are preserved under the reversal induced by \( f_{short} \) in every total context \( t \) of \( T_c \) of actual contexts C. For this reason, we can felicitously say that entities stand (or do not stand) in, e.g., the relation 'two meters taller'.

In sum, facts pertaining to the licensing of measure phrases with negative adjectives receive a straightforward explanation if negative adjectives are analyzed as denoting interval-scale properties, i.e. mappings of entities to values that do not encode their height ratios, but do encode differences in height (cf. Sassoon, 2008).

3.4 Celsius

The interpretation of some units is not generated by the general 'linguistic' rule for the interpretation of unit names proposed in (4). Rather, their interpretation is derived from the interpretation of other unit names in some systematic way. For example, the interpretation of Celsius is complicated in that its derivation involves transformation of (additive) Kelvin degrees by a fixed, conventionally established value. For any \( n \), entities that are "\( n \) Kelvin hot" are "\( n - 273 \) Celsius hot". So a box is 1 degree Celsius
iff it is 274 degrees Kelvin, but a box is 1 degree Celsius more than a shelf iff the box is 1 degree Kelvin more than the shelf, not 274 degrees Kelvin more.

The numbers that Celsius assigns to entities do not adequately represent quantities of heat (or temperature), e.g., the fact that the heat in two cells together equals the sum of heat in the two separate cells (i.e. that for any $t$, $f_{hot}(d_1 \oplus d_2) = f_{hot}(d_1) + f_{hot}(d_2)$). For example, if cells $d_1$ and $d_2$ each contains the heat of 2 Kelvin degrees ($2 \times r_{Kelvin}$), each falls under (2 – 273) degrees Celsius, and the heat contained in both of them together, the heat in 4 Kelvin unit objects ($4 \times r_{Kelvin}$), falls under (4 – 273) degrees Celsius. But (2 – 273) + (2 – 273) = (4 – 546) ≠ (4 – 273). Thus, Celsius does not assign $d_1 \oplus d_2$ the sum of numbers it assigns to $d_1$ and $d_2$. The heat in any entity that is an instance of 2 degrees Celsius is not twice the heat in an entity which is an instance of 1 degree Celsius. In fact, handbooks of measurement theory are equipped with explanations as to why it is senseless to say that 4 degrees Celsius is twice as hot as 2 degrees Celsius. However, despite these explanations, speakers cannot help judging this sentence to be perfectly acceptable (just like the sentence 4 meters is twice as long as 2 meters). I submit that this further supports my proposal that speakers interpret unit names in terms of the interpretation rule in (4), which is, of course, erroneous for, e.g., Celsius. This mistake reveals the fact that a generative rule, such as the one in (4), is used productively when unit names are to be interpreted.

### 3.5 More on the infelicity of positive adjectives with measure phrases

Some positive adjectives resemble negative ones in terms of the licensing of measure phrases. For example, the statement #The box is thirty degrees warm resembles the statement #The box is thirty degrees cold in being somewhat awkward. Yet, The box is 30 degrees warmer/colder than the shelf is perfectly acceptable (Kennedy, 2001). So in terms of the licensing of numerical degree modifiers, warm resembles its negative antonym cold and not other positive adjectives. My proposal can capture these facts.

First, positive adjectives for which additive (ratio-scale) measures exist may have transformation values, too (even though their measures are not reversed). Temperature predicates are an example. Well established additive tools for measuring temperature, e.g. Kelvin thermometers, exist. However, in practice, more often than not, temperature is measured by transformed (interval-scale) thermometers. The reasons are pragmatic – while we never encounter entities with absolutely no temperature (‘zero Kelvin hot’), we often experience events or entities that measure 273 Kelvin degrees. Thus, the use of transformed measures, such as the Celsius scale (which maps such entities to zero) is convenient. The existence of concepts like Celsius support the assumption that positive adjectives may be associated with transformed measures.

To summarize, the point of zero-Kelvin heat (i.e., – 273 Celsius degrees) is hardly ever relevant, experienced, or talked about by speakers who are not-scientists. Thus, for them, any choice of a zero is arbitrary (which, formally, means that in different total extensions of any actual context $c$, temperature predicates like warm are associated with different transformation values). Only when a unit name is explicitly
used, must an additive interpretation be accommodated (by switching to an extension $c'$ of $c$ where the transformation value equals zero for any $t$ of $T_c$).

In addition to capturing our blurred intuitions regarding entities with no temperature, the association of *warm* with an unspecified transformation value renders #2 degrees *warm*, but not 2 degrees *warmer*, infelicitous, as desired (cf., Section 3.3).

Thus, another source of cross linguistic variations regarding the licensing of numerical degree predicates is formed by the fact that languages may vary as to whether the measure associated with a given adjective will be transformed or not. 'Extent'-based analyses of antonymy\(^4\) fail to capture these facts (for details see Sassoon, 2008). This is a serious problem given the pervasiveness of these phenomena. Thus, the present proposal improves upon 'extent' theories of antonymy in terms of the set of facts it adequately captures, while employing the simpler and more intuitive assumption whereby gradable adjectives map entities to single points, single real numbers $r \in \mathbb{R}$.

Featherstone (to appear) discusses current trends in Psychophysics, suggesting that people *can generally build and use scales that encode differences between measures of stimuli, and sometimes also, but not necessarily, ratios*. Featherstone also makes an interesting new case for this claim, based on the experimental research of judgments of linguistic wellformedness. Featherstone shows that more accurate and informative results are obtained when subjects are encouraged to rank differences, rather than ratios, between the wellformedness of different linguistic structures, and when the data is processed accordingly. Featherstone's new view is in line with my assumption that the degree functions of many positive adjectives do not represent ratios, as they do not have a uniquely determined, agreed upon zero point (either in the first place, or because they are transformed) and that ratio statements are used only when additional information is presupposed (regarding the zero point, or regarding the transformation value being equal to zero).\(^5\) The adjective *felicitous* forms an example of an adjective for which no zero point exists in the first place, yet differences between degrees accurately describe differences in felicity. Most plausibly, the majority of positive adjectives denote measures with all the properties of interval-scales (and not necessarily all the properties of ratio-scales) in the first place. When subjective judgments or internal states (e.g., degrees to which things feel heavy, loud, warm, tasty, funny, felicitous, nice, happy, organized, etc.) are at stake, the likelihood that speakers will regard the measure as additive (ratio-scale) is reduced. Speakers may use ratio-statements (or consider them acceptable) to the extent that their beliefs allow for the possibility that ratio measures exist (and they may use measure phrases if, in addition, conventions regarding unit objects exist).

\(^4\) Examples include von Stechow (1984b) and Kennedy (1999, 2001).

\(^5\) A common experimental practice in the social sciences is to present subjects with a numerical scale while instructing them that the differences between any two adjacent values are identical. When the scale has a zero point (representing complete absence of the measured property), data analysis relying on addition and multiplication (e.g., averaging, t-test, etc.) is considered appropriate, i.e. subjects are thought of as capable of producing ratio judgments in the given circumstances.
3.6 Conclusions

Part 3 presents compelling support for my proposal, whereby measurement theory's taxonomy of measures (cf. Part 1) and its conception of unit based measurements (cf. Part 2) apply to linguistics and explain a large number of semantic and distributional facts regarding unit names and measure phrases, including facts pertaining to adjectives that combine with unit names to form measure phrases (e.g., tall), adjectives that have no unit names as it is impossible to agree on conventional unit objects for them (e.g., happy), and adjectives that have no unit names as their degree function does not encode ratios (e.g., short), but whose comparatives can be modified by measure phrases combined from, e.g., their positive antonyms and their unit names. Finally, Celsius is an exceptional unit name, which nonetheless is interpreted by native speakers based on rule (4), thus further supporting the view that based on this rule, unit names are productively generated and interpreted.

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On the Temporal Use of the Focus Particle _gerade_

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Abstract
In this paper, we demonstrate that the analysis for the non-temporal uses of the German particle _gerade_ developed in Schaden & Tovena (2008) applies to the temporal use of the particle as well. We also show that the non-temporal uses of _gerade_ display a conventional association with focus (cf. Beaver & Clark (2007)), and explore the hypothesis that the same type of focus dependency is at stake with the temporal use, namely the ‘progressive’ and the ‘immediate anteriority’ readings. These readings are analysed as cases of association with Aspect-Phrase and Perfect-Phrase, respectively.

1 Introduction

1.1 Uses of Gerade

The German particle _gerade_, whose literal meaning is ‘straight’, often translates in English as _just_ or _precisely_. _Gerade_ is generally considered to be a focus sensitive particle (Altmann, 1978; König, 1991b). A first use, which nicely illustrates its focus sensitivity, is exemplified in (1) and is referred to hereafter as the ‘precisely’ use. Considering cars that are often stolen, (1a) says that red cars are prototypical instances of such a car type. The alternative values for red cars are, for instance, green cars, blue cars, yellow cars, etc. On the other hand, in (1b), considering red things that are often stolen, it is said that red cars are prototypical instances of such red things. In this second example, the alternatives to be considered would be red bikes, red ships, red planes, etc. In line with what observed in much research on the meaning of focus, a different focus assignment, therefore, changes the alternatives to be considered.

(1)  a. Gerade [ROTE]_F_ Autos werden oft gestohlen
    Gerade red cars become often stolen.
    ‘Precisely RED cars are often stolen.’

     b. Gerade rote [AUTOS]_F_ werden oft gestohlen.
     Gerade red cars become often stolen.
     ‘Precisely red CARS are often stolen.’
We have glossed above the meaning impact of *gerade* with ‘prototypical’. Note, however, that the information in focus is highly contingent, in the sense that it is not understood to be related with other structures such as a scale, be it expected/probable/culturally standard or other. Though the exact nature of the particle continues to elude us, we have provided in (Schaden & Toven, 2008) some arguments against characterising it as scalar in itself. Nevertheless, *gerade* is compatible with scalar readings brought about by other elements, e.g. the adverb *oft* in (1).

*Gerade* also exhibits a temporal use, which comes in two variants, namely the so-called progressive and immediate anteriority readings. The progressive reading arises with simple tenses (i.e., the *Präteritum*, *Präsens* and simple future), as illustrated in (2).

(2) a. Otto isst Schokolade.
   O. eats chocolate.
   (i) ‘Otto eats chocolate (in general).’
   (ii) ‘Otto is eating chocolate (now).’

b. Otto isst gerade Schokolade.
   O. eats gerade chocolate.
   (i) *‘Otto eats chocolate (in general).’
   (ii) ‘Otto is eating chocolate (now).’

In (2a), we see that a sentence with a verb in the present form can be interpreted as describing an enduring generic property, as well as an ongoing action or a (very) temporary habit. But when *gerade* is added, only the latter reading remains available, as is shown in (2b).

The second temporal reading is the so-called immediate anteriority reading, exemplified in (3). It resembles very closely the effect of English *just* when combined with a perfect tense.

(3) a. Kunigunde hat einen Brief geschrieben.
   K. has a letter written.
   ‘Kunigunde has written a letter.’

b. Kunigunde hat gerade einen Brief geschrieben.
   K. has gerade a letter written.
   ‘Kunigunde has just written a letter.’

In (3a), the verb in the perfect form indicates that the action took place at some time in the past. When *gerade* is added, the location in time is constrained insofar as the action is understood as having taken place in the very recent past.

Contrary to what we have seen for ‘precisely’ *gerade*, in sentences with temporal *gerade*, the association pattern with focus is not quite clear. Indeed, in such sentences, there is not necessarily a clear-cut, accent-marked associate like in sentences with ‘precisely’ *gerade*. One might wonder, however, if focus marking is really absent in such sentences, or if it is merely ‘hidden’ under other patterns of accent placement. If *gerade* associated in some way with the VP, a focus accent on the last VP constituent might be confounded with the default accent in unfocussed sentences. An obvious question to ask is then, whether the ‘precisely’ and the temporal uses are manifestations of the same
focus sensitive particle. It is worth trying to make more precise the type of sensitivity to focus marking that *gerade* displays.

1.2 On the type of association with focus

In their recent monograph, Beaver & Clark (2007) identify different types of sensitivity to focus. In particular, they characterise additive, e.g. *also*, exclusive, e.g. *only*, and intensive particles, e.g. *exactly*, all as items that show CONVENTIONAL ASSOCIATION to focus. These items are to be distinguished from adverbials such as *always*, that perform quantification over an implicit domain recovered from context and whose degree of association they argue is less strong. So, does *gerade* display a conventional association to focus, or not?

Building on an observation by Krifka (1992), Beaver & Clark (2007) demonstrate that *always* does not share the type of focus sensitivity of *only*. Their argument goes as follows.1

(4) a. Mary always took [Fred]$_F$ to the movies.
   b. Mary only took [Fred]$_F$ to the movies.

(4a) means that if Mary took someone to the movies, it was always Fred; (4b) can be paraphrased as “the only person such that Mary took him to the movies is Fred”. Now, what would happen if the focus-marked element were extracted? Could the focus sensitive element associate with the trace left behind? The answer of Beaver & Clark (2007) is that it depends. *Always* can, but *only* cannot. The relevant contrast is reproduced in (5) and (6).

(5) We should thank the man, whom Mary always took $t_i$ to the movies.
   a. ‘We should thank the man such that, if Mary took someone to the movies, it was always him.’ [association with trace]
   b. ‘We should thank the man such that Mary has always taken him to the movies (and nowhere else).’ [association with “to the movies”]

(6) We should thank the man, whom Mary only took $t_i$ to the movies.
   a. *‘We should thank the man such that, Mary took only HIM to the movies.’ [association with trace]
   b. ‘We should thank the man such that Mary has only taken him to the movies (and nowhere else).’ [association with “to the movies”]

As we can see, the relevant reading is impossible with *only*, but remains possible with *always*. How does *gerade* fare with respect to this test? First consider (7).

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1Actually, their argument exploits several tests. We use the test on extraction because it is easy to replicate for *gerade*. Although we cannot elaborate on it here, as far as we have checked, the results of the other tests that can be applied to German concur with the extraction test with respect to the class of association with focus that *gerade* falls into.
A few remarks are in order with respect to (7). It is generally assumed that in German subordinate clauses, the constituents are in base position, which is SOV. With an intonation pattern like the one indicated in (7), the sentence may be interpreted in two ways: as containing either ‘precisely’ gerade focalising on diesen Mann, or as an immediate anteriority temporal gerade. Notice furthermore that, if the accent were on zum Essen, and if gerade remained where it occurs in (7), as is illustrated in (8), a ‘precisely to dinner’ interpretation is not possible.²

²(8) has an immediate anteriority interpretation, which we leave aside for the moment.

A sentence corresponding to (9) has a ‘precisely’ reading, where gerade focalises on zum Essen. But then, if our conclusion from example (8) is correct, gerade should directly precede zum Essen, and not the trace ti, so that we obtain the structure in (10):

(i) deni Maria ti gerade [ZUM ESSEN]iF eingeladen hat. whom M. ti gerade to the eating invited has.

As we can see, gerade cannot associate with the trace of the extracted element diesen Mann in (9).³ This piece of data, therefore, provides evidence that gerade behaves like only and qualifies as conventionally associated to focus — at least in what we have qualified as the ‘precisely’ reading.

The question is whether the temporal gerade is also conventionally associated to focus. Examples like (10-a) might cast doubt about that, since the particle seems to associate with a trace here. Notice, however, that extremely similar phenomena have been

³A sentence corresponding to (9) has a ‘precisely’ reading, where gerade focalises on zum Essen. But then, if our conclusion from example (8) is correct, gerade should directly precede zum Essen, and not the trace ti, so that we obtain the structure in (10):

(i) deni Maria ti gerade [ZUM ESSEN]iF eingeladen hat. whom M. ti gerade to the eating invited has.
observed with rather unproblematic exclusive particles of German where no polysemy has ever been considered (at least as far as we know).

\[(10)\]

a. Maria tanzt gerade \(t_i\).

M. dances precisely \(t_i\).

‘Maria is dancing.’

b. Maria küsst ihn nur \(t_i\).

M. kisses him only \(t_i\).

‘Maria only K I S S E S him.’

Beaver & Clark (2007) consider several different possibilities in order to account for (10-b), while still allowing a particle like nur to be within the realm of conventional association with focus. In this paper, we do not want to commit ourselves to any specific possibility. The only point we want to make with the examples in (10) is that there is no need to postulate two different homonymous *gerade* on the basis of different focus association properties. We also want to point out that (potential) problems for the account of Beaver & Clark (2007) arise in German when focus on the verb (or elements encoded on the verb) are involved. Our account of the temporal readings of *gerade*, as developed in section 3 (p. 491ff.) will assume an association with the Aspect-Phrase of a clause.

In order to account for the temporal interpretation that is available in (9), we can hypothesise that it arises when *gerade* scopes right above the functional projection Aspect-Phrase. Pitch accent may signal a lower attachment to the DP node, which results in the particle scoping only over the object in a sentence like (7a), although the endresult is the same as in (7b) in terms of linear order.

This hypothesis is compatible with the fact that *gerade* preposed to the focus marked subject DP allows only for a ‘precisely’ reading, as shown in (11).

\[(11)\]

*Gerade [MARIA] hat diesen Mann zum Essen eingeladen.*

*gerade M. has that man to the eating invited.*

‘Precisely Maria invited this man to dinner.’

We assume thus that the temporal reading can be analysed as involving the same item *gerade*, with the same semantics that gives also rise to the ‘precisely’ reading. This seeming case of polysemy would be a case of multi-typed element, typical of additive and exclusive particles, and the readings should be linked to the nature of the focused element. Therefore, tackling first things first, in this paper we set ourselves the task of showing that it is possible to extend to the temporal uses the analysis of *gerade* that we presented in (Schaden & Toven, 2008), according to which it is a focus sensitive element that sharpens the perception of adequacy of the description provided by the associate.

The rest of this paper is organised as follows. In section 2, we briefly recall the main tenets of our proposal. Then in section 3, we show that it can cover the temporal use. We discuss the progressive reading and we show how temporal progression is blocked and that the state of affairs is contingent. We then examine the immediate anteriority reading, which arises with perfects. The discussion of the case where perfects give rise to progressive readings closes the section. Finally, section 4 concludes the paper.

\[4\]In (10-b), the exclusive seems to be either associated with a trace or to be non-contiguous postpositional.
2 A proposal for ‘precisely’ *gerade*

In this section, we summarise the analysis proposed in (Schaden & Tovenà, 2008), where we have argued that *gerade* sharpens the perception of adequacy of a property for characterising a particular entity. Our proposal captures this identificational flavour, which seems to be the same intuition that König (1991a) expresses by saying that *gerade* is used to emphatically express identity between two values. However, it differs from König’s proposal in some crucial points. On the one hand, we have argued that it is not just plain identity between two equal values. The set characterised by the associate is said to provide the best match for the most prototypical part of the set characterised by the background. Furthermore, the correspondence holds between extensions, hence it is contingent and informative. For König, on the contrary, informativity comes from the dissonance between the two identified values.

We stated our idea within the foreground-background implementation of focus developed by von Heusinger (1999) inside the DRT framework and within an alternative-based approach to focus. In short, focus is assumed to induce the construction of two different and related representations of a sentence, namely the **foreground**, containing all material supplied by the host sentence, and the **background**, which is a way of representing the alternatives, as it corresponds to a representation like the foreground where the focus value has been abstracted away and replaced by a variable. This is illustrated, in a simplified version, in (12) for (1a).

\begin{align*}
\text{(12) } & \text{a. Background:} \\
& \begin{array}{|c|}
\hline
x \\
\hline
\text{car}(x) \\
\text{X}(x) \\
\text{get\_often\_stolen}(x) \\
\hline
\end{array} \\
& \text{b. Foreground:} \\
& \begin{array}{|c|}
\hline
x \\
\hline
\text{car}(x) \\
\text{red}(x) \\
\text{get\_often\_stolen}(x) \\
\hline
\end{array}
\end{align*}

Background and foreground are related by a function \( h \) that corresponds to the assignment function for the designated variable \( X \) for the focus information, and which is an extension of function \( g \) that has fixed all values in the background. *Gerade* denotes conditions on assignment functions between background and foreground.

Reconsider example (1a). Given the background information \( B \) cars that are often stolen, *gerade* points at the subset of it which is viewed as the most prototypical one and tells us that this (nonempty) subset extensionally corresponds to the set characterised by the associate. The correspondence is computed via a measure function \( \mu \) that, when applied to the focussed property \( P \), here ‘red’, returns a higher value than that returned by any other property \( P' \) considered to be a relevant alternative to \( P \) in the given context \( C \). The function \( \mu \) establishes the match between the prototype of \( B \) and the associate as the best fit in \( C \), although not necessarily unique in general. The definition is provided in (13), where AFV stands for ‘actual focus value’, and \( \phi[X] \) stands for a formula \( \phi \) containing a condition \( X \).

\begin{align*}
\text{(13) } & \llbracket \text{gerade} \rrbracket = \exists h \exists g (\llbracket \phi[X] \rrbracket^{g,h} = 1) \land h(X) = \text{AFV} \land \exists \mu (C(\mu) \land \forall h'(h'(X) \neq h(X) \rightarrow \\
& \mu(h'(X)) > \mu(h(X))))
\end{align*}
For example (1a), (13) amounts to saying that all alternative assignments $h'$ for cars with some property $X$ other than being red, are contextually lower valued for being often stolen cars, so cars that are most typically often stolen are the red ones. Hence, the effect of sharpening the descriptive power of a property is the result of a comparative instruction. *Gerade* expresses an evaluation of the associate, not a direct ranking among alternatives.

The next step is to show that this analysis can cover the temporal uses.

### 3 Analysering the temporal uses

#### 3.1 The progressive use

We call the first temporal reading the ‘progressive’ reading, since in Dahl (1985), *gerade* has been identified as the German expression of a progressive aspect. Notice, however, that the effect of *gerade* does not always correspond to a standard progressive like the English *be-ing*, cf. (Schaden, 2007, to appear). Rather, the progressive use appears when the particle is associated with aspectually neutral tenses, in the sense of Smith (1991). Such tenses—for instance, the German *Präteritum, Präsens* or simple future tense—display a systematic ambiguity between two readings, namely a causal, sequential reading, i.e. one event after the other, cf. (14-a), and an incidental reading, i.e. one event has already begun when the other takes place, cf. (14-b).

(14) Als Maria das Zimmer betrat, pfiff Max.
When M. the room entered, whistled M.
   a. ‘When Maria entered the room, Max whistled.’
   b. ‘When Maria entered the room, Max was whistling.’

If *gerade* is added to the main clause of such a sentence, it blocks the normally possible sequential or causal reading and forces an incidental reading, even where the context strongly favours the sequential reading, cf. (15). Thus, *gerade* eliminates a reading, rather than introducing one.

(15) a. Als der Polizist seine Papiere verlangte, rastete Otto aus.
When the policeman his documents demanded$_{Prät}$, flipped$_{Prät}$ O. out.
   (i) ‘When the policeman asked for his identity card, Otto flipped out.’
       [extremely dominant reading]
   (ii) ‘When the policeman asked for his identity card, Otto was flipping out.’ [extremely marginal reading]

b. Als der Polizist seine Papiere verlangte, rastete Otto gerade aus.
   (i) *‘When the policeman asked for his identity card, Otto flipped out.’
   (ii) ‘When the policeman asked for his identity card, Otto was flipping out.’
Progressive *gerade* can combine in principle felicitously with states, but this only to the extent that these states are temporary and open to change. States that are not supposed to change are unacceptable (or acceptable only to the degree that they can be coerced into a temporary state), cf. (16).

(16) a. ??7 ist *gerade* eine Primzahl.
   
   ’7 is a prime number (for now/these days).’

b. ??Fred Sinowatz ist *gerade* tot.
   
   ‘Fred Sinowatz is dead (for now).’

(16-a,b) are perfectly acceptable in circumstances where the rules of mathematics change periodically, and in which Fred Sinowatz rises periodically from the death.

We assume that the temporal readings can be derived via a focus-background structure just like the non-temporal uses of *gerade*. In case of the progressive reading, we assume that the verbal predicate is part of the associate, and this holds in general for both temporal readings. More precisely the associate is formed by the Aspect-Phrase and the VP in (17).

(17) a. Als Peter kam, ging Paul gerade.
   
   ‘When Peter came, Paul was leaving.’

b. Background:

   \[
   \begin{array}{c|c}
   x, n, i & \text{named(}Paul, x) \\
   \hline
   i \prec n & \text{Tense}
   \end{array}
   \]

   \[
   \begin{array}{c|c}
   X(i) & \text{VP}
   \end{array}
   \]

c. Foreground:

   \[
   \begin{array}{c|c}
   x, n, i, e & \text{named(}Paul, x) \\
   \hline
   i \prec n & \text{Tense}
   \end{array}
   \]

   \[
   \begin{array}{c|c}
   e \circ i^5 & \text{Aspect}
   \end{array}
   \]

   \[
   \begin{array}{c|c}
   \text{leave}(x, e) & \text{VP}
   \end{array}
   \]

Here, \( n \) stands for the moment of utterance. The important thing to notice is that the interval \( i \), which corresponds to the Reichenbachian moment of reference \( R \), is part of the background. Therefore, it must be discourse-given. Narrative progression in DRT is achieved by the introduction of a new point \( R \) into the DRS. Since \( R \) is given here, it must be identified in the context, and one cannot introduce freely a new point of reference. In this way, we can block temporal progression, and thus eliminate the sequential reading. Note that, according to this analysis, *gerade* does not impact directly the admissible aspectual relations, contra what has been proposed in (Schaden, 2007, to appear).

The same move also enables us to correctly predict the oddity of sentences containing *gerade*, where \( R \) cannot be inferred from the context, as identical to the moment of utterance, or by discourse anaphora. For instance, assume (18) is uttered out of the blue.\(^6\)

\(^5\)We note the neutral aspectual configuration by ‘\( ° \)’. See Smith (1991), Pancheva (2003), Reyle et al. (2007) or Schaden (2008) for different definitions of the exact content of such a relation.

\(^6\)An anonymous reviewer suggested to place \( R \) in the foreground. But example (18) provides good evidence for placing \( R \) in the background.
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Because of the past tense, we cannot identify R with the moment of utterance. At the same time, we cannot resolve R anaphorically either, since there is no context. Therefore, (18) cannot be felicitous.

So far, we have accounted for parts of the progressive effects. We need to derive one thing more, namely that the predicate must be open for change under the progressive reading. In order to see how this can be achieved, first recall that, as a focaliser, by definition gerade involves comparison amongst alternatives to the asserted focus value. Furthermore, the focus value at R needs to be contingent. Whenever this value is necessarily true or excludes relevant alternatives, we predict it to be infelicitous. This correctly excludes examples such as (16), at least in normal worlds.

The contingent nature of the predicate is derived by requiring additionally that the predicate be able to evolve through time. Intuitively, sentences like (16) become felicitous if one can have moments of \( p \) and moments of \( \neg p \). A sentence with progressive gerade is true at R, but as a contingent fact. This is the basic contribution of the particle. Facts that are contingent at one moment in time normally do not become necessary truths for other moments. Although nothing is explicitly asserted about whether the state of affairs expressed by the sentence is true or not for moments other than R, it is the case that such a state of affairs must be able to be false at these other moments, in virtue of its being contingent.

Adding a specific constraint imposing \( \neg p \) at a time prior to R would be too strong, as can be illustrated with example (19).

Adding a specific constraint imposing \( \neg p \) at a time prior to R would be too strong, as can be illustrated with example (19).

(19) Die Kinder, die gerade in diesem Krankenhaus waren, wurden alle mit dem Virus infiziert.
   ‘The children who happened to be in this hospital were all infected with the virus.’

(19) can be paraphrased as follows, for any \( x \) such that \( x \) is a child and \( x \) was at the hospital at \( t \), \( x \) was infected with the virus at \( t \). Crucially, (19) does imply that children who have never been at any other place than the hospital are excluded from contamination, e.g. new-born babies.

3.2 The immediate anteriority reading

3.2.1 Perfect forms and the immediate anteriority reading

Immediate anteriority readings arise with perfects, cf. (20-a), and double-compound perfects (20-b). A more detailed exposition of the data is provided in (Schaden, 2007, to appear).
(20) a. Als Kunigunde gerade alle Beweise beseitigt hatte, stürmte die Polizei ihre Wohnung.
   ‘When Kunigunde had just eliminated all proof, the police stormed her flat.’

b. Otto sagte mir, als er Herrn Meier angerufen habe, habe dieser seinen Artikel gerade gelesen gehabt.
   ‘Otto told me that, when he had called Meier, Meier had just finished reading his article.’

There is a slight complication to this generalisation, however: gerade, when combined with perfects, also allows for progressive readings:

(21) Als Maria das Zimmer betreten hat, hat Max gerade gepiffen.
   ‘When Maria entered the room, Otto was whistling.’

In order to properly account for the behaviour of perfects, which allow for both progressive and immediate anteriority readings, we assume that gerade can scope either over the anteriority relation—contained in both double-compound and ‘simple’ perfects—, or the underdetermined aspectual relation—contained only in ‘simple’ perfects. As we will see below, in the latter case our analysis is identical to those of the progressive case with the Präteritum.

According to the literature, the anteriority relation might be encoded at two different levels, namely as an aspect, see e.g. de Swart (1998), or as a relative tense, see e.g. Pancheva (2003). Even if one assumes that in ‘simple’ perfects, the anteriority relation is encoded as a relative tense, the aspectual variant is required at least for double-compound perfects, see (Schaden, 2007) for an argument that German double-compound perfects are aspectually resultative. Thus, a sentence like (22) might be analysed either as in (23), which corresponds to the aspectual variant, or as in (24), which is the temporal variant.

(22) Hans ist gerade angekommen.
    ‘Hans has just arrived.’

In (23), the background contains tense, and the distinguished variable is a predicate over the moment of reference. The perfect semantics used here is the one of de Swart (1998). The perfect introduces a result state $s$, which temporally abuts the temporal trace of the eventuality $e$.

\footnote{The reading marked as unavailable would be possible if (21) did not contain gerade.}
The temporal use of *gerade*

(23) a. Background:
   \[
   x, n, i
   \]
   Named(Hans,x)
   \[
   n \subseteq i
   \]
   X(i)

b. Foreground:
   \[
   x, n, i, e
   \]
   Named(Hans,x)
   \[
   n \subseteq i
   \]
   \[
   i \subseteq s
   \]
   \[
   e \supset s
   \]
   arrive(x,e)

The temporal variant of (22) assumes that the perfect is a relative tense introducing a perfect state \( s \) (cf. Nishiyama & Koenig (2004)), under which there is an aspectual projection.

(24) a. Background:
   \[
   x, n, i
   \]
   Named(Hans,x)
   \[
   n \subseteq i
   \]
   X(i)

b. Foreground:
   \[
   x, n, i, i', e
   \]
   Named(Hans,x)
   \[
   n \subseteq i
   \]
   \[
   i \subseteq s
   \]
   \[
   Q(s)
   \]
   \[
   i' < i
   \]
   [relative T.]
   \[
   e \circ i'
   \]
   [Aspect]
   \[
   arrive(x,e)
   \]
   [VP]

In (24), the two lines between what we have marked *Tense* and *relative Tense* concern the temporal location of the perfect state \( s \), and its nature \( Q \). \( Q \) is assumed to be a free variable, and has to be inferred by pragmatic means based on the context.

Though the formulæ in (23) and (24) are not identical, they are quite similar. The state \( s \) plays a crucial role in both cases. The explanation for the immediate anteriority effect will follow the following pattern in both cases. The effect of *gerade* is to establish a state \( s \) as best match for the interval \( i \). Now, \( s \) is only very vaguely specified. Its characterization depends on the main eventuality \( e \) of the sentence, and possibly also on the relation of \( e \) with the preceding discourse-context, cf. Portner (2003). If \( s \) is determined by \( e \), \( e \) will play a role in the evaluation of the adequacy of \( s \). In order for \( e \) to be maximally pertinent for \( s \), and reciprocally, there need to be no other intervening event of the same type or of a type that could interfere in the relation between \( e \) and \( s \). This will involve a certain degree of temporal proximity, though a rather vague one. What is not vague is the perception of a relevant type of proximity, and it is important to underscore that here what is taken into consideration are not only elements known to both speaker and hearer. It is not a question of (subjective) relevance, but an objective constraint of proximity.\(^8\)

### 3.2.2 Accounting for the progressive reading of perfects

Under the assumption that the German Perfect encodes a relative-tense feature, we can tackle also the progressive readings that arise with such tenses. We only have to assume

\(^8\) *Gerade* seems to be ‘objective’ in this sense in some of its non-temporal uses too, cf. Schaden & Tovenia (2008).
that, in this case, gerade applies to an underspecified Aspect-Phrase below the Perfect-projection, as is illustrated in (26). Contrary to what has happened in all preceding examples, there is more structure in the background here than just the tense relation and presuppositional elements of the DRS.

(25) Der Hans ist gerade angekommen, [als die Maria auf die Bühne gegangen ist.] The Hans is gerade arrived, when the Maria on the stage went is. ‘Hans was arriving, [when Maria went on the stage.]’

(26) a. Background: 

<table>
<thead>
<tr>
<th>x, i, i′, n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Named(Hans, x)</td>
</tr>
<tr>
<td>n ⊆ i</td>
</tr>
<tr>
<td>i ⊆ s</td>
</tr>
<tr>
<td>Q(s)</td>
</tr>
<tr>
<td>i′ ≺ i</td>
</tr>
<tr>
<td>X(i′)</td>
</tr>
</tbody>
</table>

b. Foreground: 

<table>
<thead>
<tr>
<th>x, i, i′, n, e</th>
</tr>
</thead>
<tbody>
<tr>
<td>Named(Hans, x)</td>
</tr>
<tr>
<td>n ⊆ i</td>
</tr>
<tr>
<td>i ⊆ s</td>
</tr>
<tr>
<td>Q(s)</td>
</tr>
<tr>
<td>i′ ≺ i</td>
</tr>
<tr>
<td>e ⊆ i′</td>
</tr>
</tbody>
</table>

arrive(x, e)

The remainder of the argument goes as for the progressive reading we have already seen.

4 Conclusion

In this paper, we have shown that gerade displays a conventional association with focus in its non-temporal use, and we have argued that nothing prevents the extension of this analysis to the temporal use.

Given this uniform type of focus dependency, we have proposed a unified semantic analysis. We have built on our previous proposal (Schaden & Toven, 2008) that the different readings of gerade can be analysed as manifestations of a unique role of the particle, namely indicating the optimal match. Technically, this unique role is captured via a measure function that assigns the highest measure to the associate (via an evaluation of the focus). The indication of an optimal match is also at work in the temporal uses. The progressive and immediate-anteriority readings follow from the scope of gerade w.r.t. different temporo-aspectual relations.

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References


What is Amazement all about?

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Abstract
This paper deals with DPs embedded in expletive constructions with emotive adjectives that are interpreted like \( wh \)-exclamatives. This class of DPs seems to be constrained to degree and kind referring ones. I focus on the problem of a uniform semantics for the construction given that monotonicity entailments arise for the first but not for the latter.

1 Introduction

Adjectives or adverbs like amazing(ly), surprising(ly),... can appear in expletive constructions that contain a DP which could be replaced by a \( wh \)-exclamative without a noticeable change in literal meaning.

(1) a. It’s amazing [\( DP \) the big car he bought]. 
≈ what a big car he bought

b. It’s amazing [\( DP \) the height of that building]. 
≈ what a height that building has

Grimshaw (1979) calls such DPs Concealed Exclamations (henceforth, CES). Further examples are given in (2).

(2) a. John couldn’t believe [\( DP \) the height of the building]. 
≈ what a height the building was

b. You wouldn’t believe [\( DP \) the things I see here on the roads].
≈ what things I see here on the roads

The name makes explicit an obvious parallel with Concealed Questions (CQs) - DPs that make the semantic contribution of embedded interrogatives (cf. Baker, 1968; Heim, 1979).

1http://twitter.com/TomRaftery/statuses/934123003
2For recent discussion see Nathan (2006) and further references in Castroviejo-Miró and Schwager (2008).
John told me [DP the capital of Italy].  
\[ \approx \text{what the capital of Italy is} \]

CEs and CQs raise the question of how DPs come to behave like embedded clauses. Following the by now prevalent view, I assume that these phrases are truly DPs in syntax (and not clauses parts of which have undergone deletion).

CEs and CQs are highly restrictive in what DPs they allow as an argument. In Castroviejo-Miró and Schwager (2008) (henceforth, CS-08), we show that the restrictions imposed differ across these two classes, but even across different CE-constructions. We consider this evidence that the lexical entry of the embedding predicate is responsible for the clause-like contribution of the respective DP as well as for the restrictions on its syntactic and semantic properties. Therefore, in this paper, I focus exclusively on CEs occurring in expletive constructions like (1).

I build on CS-08’s generalisation that the crucial restriction concerns the DPs ability to pick out a degree or a kind. I recapitulate our proposal to unify degrees and kinds as dual types and focus on a problem arising with monotonicity: if (1-b) is true, the speaker expected the house to be smaller, not just of any other height. Ultimately, I argue for a modification of CS-08’s account that brings it closer to Rett (2008a)’s analysis for unembedded exclamatives, while maintaining the restrictions on what DPs can occur in such expletive CE-constructions.

2 Getting to know the amazing-constructions

Evaluative adjectives like amazing, surprising, terrible, awful, stupid, . . . and the corresponding adverbs appear in various syntactic configurations. This gives rise to interesting differences in interpretation, e.g. Morzycki (2004); Katz (2005); Nouwen (2005) for contrasts between (4-a) vs. (4-b).

(4) a. John is amazingly tall.
   b. Amazingly, John is tall.
   c. It is amazing that John is tall.
   d. It’s amazing how tall John is.

In this paper, I focus on the contrast between amazing as occurring in predicative position (amazing_simpl, exemplified in (5-a)) vs. the expletive CE-Construction (amazing_expl, exemplified in (5-b)).

(5) a. John is amazing.
   b. It’s amazing the stupid things he says.
Syntactically, *amazing\textsubscript{simpl}* allows for any type of quantificational or referential DP, but *amazing\textsubscript{expl}* requires its postposed DP to be a definite DP (cf. Portner and Zanuttini, 2005).

(6) It’s amazing the/*a/*every secret that Matthew spread.

Semantically, we observe at least the following differences between *amazing\textsubscript{simpl}* and *amazing\textsubscript{expl}*. Firstly, *amazing\textsubscript{simpl}* allows for substitution of co-extensional expressions *salva veritate*, cf. (7), while *amazing\textsubscript{expl}* does not, cf. (8):

(7) John is amazing.
    John is Mary’s boyfriend.
    \[\therefore\text{ Mary’s boyfriend is amazing.}\]

(8) It’s amazing the boyfriends Mary had last year.
    The boyfriends Mary had last year were exactly the students
    Peter had last year.
    \[\therefore\text{ It’s amazing the students Peter had last year.}\]

Secondly, *amazing\textsubscript{simpl}* attributes amazingness to an individual. In contrast, *amazing\textsubscript{expl}* expresses (roughly) that the DP has a different extension from what was expected.

(9) It’s amazing the number of people who look the other way.
    \[\approx \text{It’s amazing what } n \text{ is such that } n\text{-many people look the other way.}\]

But the difference cannot just be between individuals and individual concepts. The examples in (11-b) and (11-c) are just as bad as (11-a) and cannot be understood in the obvious sense.\(^4\)

(10) a. The president of the US is amazing.
    b. Barack Obama is amazing.

(11) a. #It’s amazing Barack Obama.
    b. #It’s amazing the president of the US.
    \[\neq \text{It’s amazing who is the president of the US.}\]
    c. #It’s amazing the presidents of the most powerful countries.
    \[\neq \text{It’s amazing who are the presidents of the most powerful countries.}\]

Perspicuously many DPs following *amazing\textsubscript{expl}* contain relative clauses. Portner and Zanuttini (2005) argue that the presence of a relative clause is (i) obligatory and (ii) directly responsible for the phenomenon that these DPs achieve exclamative like meanings. In CS-08, we argue against both assumptions. On the one hand, we find both DPs without relative clauses that can appear under *it’s amazing* (cf. (12-a)), and DPs with relative clauses that cannot (cf. (12-b)).

(12) a. It’s amazing [the height of that building].
    b. #It’s amazing [the man [who climbed Mount Everest]].

\(^4\)I ignore referential readings for *it* in (11) and other examples.
Portner and Zanuttini (2005) claim that (i) and (ii) apply also to DPs used as stand-alone exclamatives, henceforth, Nominal Exclamatives (Ne).\(^5\) Our findings carry over to this class as well:

\[(\text{13})\]
\[\begin{align*}
&\text{a. The height of that building!} \\
&\text{b. (to the proud architect: ) ?The height of the dome!} \\
&\text{c. #The man who climbd Mount Everest!}
\end{align*}\]

On the other hand, in some cases, the relative clauses seem to be embedded too deeply in order for Portner and Zanuttini (2005)’s mechanism to derive the intended exclamative denotation (a particular set of propositions).

\[(\text{14})\]
\[\text{It’s amazing [DP the number of [ people [CP you meet at those parties]]].}\]

On the basis of a small database collected online,\(^6\) CS-08 conclude that the class of DPs embeddable in the amazing\(_{\text{expl}}\)-construction contain either (i) arbitrary head nouns modified by relative clauses (class 1), or (ii) head nouns that express gradable properties (height, amount, . . . ; class 2), or (ii) overt kind/manner-like modifiers (kind, way, . . . ; class 3).\(^7\)

Moreover, examples in class 1 (that is, DPs containing relative clauses that modify the head noun), express either (a) amazement at the amount/number of the modified property’s extension, or (b) amazement at the kind of entities that fall under the thus modified property.

\[(\text{15})\]
\[\begin{align*}
&\text{a. . . the number of people you meet at these conferences} \\
&\text{b. . . the kind of people you meet at these conferences}
\end{align*}\]

Relative clauses are well-known to induce kind or degree readings in other contexts as well (cf. Carlson, 1977; Heim, 1987; Grosu and Landman, 1998).

\[(\text{16})\]
\[\begin{align*}
&\text{a. It will take us the rest of our lives to drink the champagne they spilt last night.} \\
&\text{b. We will never be able to recruit the soldiers the Chinese paraded on May 1.} \\
&\text{c. You no longer see the telephones that there were in my grandmother’s time.}
\end{align*}\]

So, obviously, the DP embedded under amazing\(_{\text{expl}}\) has to be interpreted as referring to degrees or kinds. Furthermore, this degree or kind reference has to be index-dependent.

\(^5\)This use of the terminology follows Rett (2008a) and is at odds with Portner and Zanuttini (2005)’s use.

\(^6\)We google searched for strings like “it’s amazing the”, “it’s surprising the”, “it’s stupid the”, “it’s terrible the”, “it’s wonderful the”, “it’s awful the” and manually evaluated whether the results were instances of the construction in question, and whether the context suggested native speaker competence of the source. This left us with a sample of 62 clear-cut examples.

\(^7\)The only exception to this classification came up in König (2008), who cites The nerves of some people!. Due to the idiomatic nature of the expression we will leave it aside.
Expressions that can only be rigid kind or degree designators are disallowed:

(17) a. #It’s amazing dogs/the dog.
b. #It’s amazing six meters.

Therefore, we postulate the following semantic restriction on the DP embedded under $amazing_{\text{expl}}$:

(18) **CS-08’s restriction:**
The DP embedded under $amazing_{\text{expl}}$ has to denote a function from indices to degrees or to kinds.

In section 5.2, I will compare this assumption to Rett (2008a)’s analysis of unembedded exclamatives.

### 3 Dual types and different properties

Having established (18) as the restriction on the argument of $amazing_{\text{expl}}$, CS-08 proceed to solve two puzzles: (i) what is the relation between $amazing_{\text{simpl}}$ and $amazing_{\text{expl}}$ as occurring in (19-a) and (19-b) respectively?

(19) a. John is amazing. $amazing_{\text{simpl}}$
b. It’s amazing the things you can find in the dumpster. $amazing_{\text{expl}}$

And (ii), why do degrees and kinds pattern together, that is, why are (non-trivial) functions from indices to kinds/degrees acceptable in the argument position of $amazing_{\text{expl}}$, but ordinary individual concepts are not?

#### 3.1 Kinds and degrees on a par: dual types

It is well-known that kinds and degrees pattern together in many constructions. Examples include anaphora like English *such* (Carlson, 1977; Heim, 1987), German *so* (cf. (20)) and Polish *taki* (e.g. Landman and Morzycki, 2003; Landman, 2006; Umbach and Endriss, 2008).

(20) a. Hans ist 1.80m und Maria ist auch so groß.
Hans is 1.80m and Maria is also so tall
b. Hans hat einen Beagle, und Maria will auch so einen Hund.
Hans owns a beagle and Maria wants also such a dog

In CS-08, we argue that kinds and degrees pattern together because they share the same dual nature of being properties (type $\langle s, et \rangle$) and entities. The correspondence between kinds and properties is well-established (cf. Chierchia, 1984, 1998; Landman, 2006). Non-rigid properties that are contextually associated with ’sufficiently regular behavior’ can be mapped onto kinds by the kind operator $\cap$.8

---

8The possibility of a shift between entities and properties has been argued to be independently necessary for nominalizations as in *John is nice* vs. *Being nice is nice*. For an implementation that avoids
(21) for $P$ of type $\langle s, e \rangle$: $\cap P :=$ the kind $P$ (type $e$), if $P$ picks out a class of objects that display sufficiently regular behavior, undefined else.\(^9\)

But what is the relation between degrees and properties? Degrees of instantiation of a gradable property $P$ are often considered primitive. But we can also construe the degrees to which a gradable property $P$ is instantiated by comparing individuals across worlds w.r.t. $P$ (cf. discussion in Cresswell, 1976). Such a construal leads to a one-to-one correspondence between degrees and properties.\(^10\) Consider $P = \text{height}$.

(22) a. The Empire State building is higher than the Commerzbank tower.
   b. The Commerzbank tower could have been higher.
   c. Sherlock Holmes is as tall as G. W. Bush.

Comparing them in this way, we group together individuals in a world according to their exact sizes there (we form the equivalence classes induced on $W \times D_e$ by the dimension of height):

<table>
<thead>
<tr>
<th>Height (m)</th>
<th>Equivalence Classes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.80</td>
<td>$(w_1, g.w.bush), (w_2, s.holmes), (w_3, g.w.bush), \ldots$</td>
</tr>
<tr>
<td>1.90</td>
<td>$(w_2, g.w.bush), (w_3, s.holmes), (w_4, g.w.bush), \ldots$</td>
</tr>
<tr>
<td></td>
<td>$\ldots$</td>
</tr>
<tr>
<td>259</td>
<td>$(w_1, \text{commerzbank - tower}), (w_2, \text{empire - state}), \ldots$</td>
</tr>
<tr>
<td></td>
<td>$\ldots$</td>
</tr>
</tbody>
</table>

In the same sense, the dimension of height gives us the preorder $\preceq_{\text{height}}$:

(23) $\langle w, x \rangle \preceq_{\text{height}} \langle v, y \rangle$ iff $y$ in $v$ is at least as tall as $x$ is in $w$.

To derive degree predicates (e.g. tall, cf. Cresswell, 1976) as monotone (cf. Heim, 2000), I will not identify degrees with equivalence classes directly. Rather, I use them together with $\preceq_{\text{height}}$ and construe the set $H$ of degrees of height as in (24).\(^11\)

(24) the set of degrees of height $H :=$

\[
\{ \{ \langle w, x \rangle \mid \langle v, y \rangle \preceq_{\text{height}} \langle w, x \rangle \} \mid \langle v, y \rangle \in W \times D_e \}\]

\(^*\)Note that this is a slight deviation from Chierchia (1984)'s operator that treats kinds as individual concepts. I follow Carlson (1977) and Landman (2006) in treating kinds as individuals proper.

\(^10\)Note that I do not make a case for the ontological status of degrees. Thanks to Christopher Piñon (p.c.) for discussion of this point.

\(^11\)Here I am elaborating on and deviating from the very condensed sketch in CS-08. We could equally well identify degrees with the equivalence classes and make use of $\preceq_{\text{height}}$ in the specification of degree predicates instead (replacing (26-a)).
Each degree $d_i$ is a subset of $W \times D_e$, and can thus be characterized by a function $\delta_i$ of type $(s, et)$:

(25) For each $d_i$, there is a function $\delta_i \in D_{(s, et)}$, s.t. $\delta_i(w)(x) = 1$ iff $\langle w, x \rangle \in d_i$.

If an individual $x$ is tall to degree $d$ in world $w$, this means that $\langle w, x \rangle$ is in the class called $d$. This ensures that degree predicates are downward monotone; $d$-tall entails $d'$-tall for any $d' \leq d$.

(26) a. tall$_w(d)(x) \leftrightarrow \langle w, x \rangle \in d$
   
   b. The tower is $d$-tall for $d = 259m$.
   
   $\therefore$ The tower is $d'$-tall for $d' = 1m$.

Now that degrees can be construed as functions of type $\langle s, et \rangle$ we obtain:

(27) $[\text{the height of that building}]_{(w)} = e$: the maximal degree of height $d$ s.t. tall$_w(d)(\text{that building})$

$s, et$: $\lambda w \lambda x. x$ is in $w$ at least as high as that building is in $w$

Given this conception of kinds and degrees as dual types, CS-08 adopt the following domain restriction for $amazing_{expl}$ (in the following, I will often abbreviate this restriction as $DUALTYPE(x)$).12

(28) $[amazing_{expl}] = \lambda w \lambda x_{re} : \forall w' \exists P[x(w') = DEG(P)]$ or $\forall w' \exists P[x(w') = \bigcap P],[ \ldots \text{value} \ldots ]$

Ideally, the value assigned should be related to the semantics of $amazing_{simpl}$.

### 3.2 amazing as having different properties

In section 2, we have seen that $amazing_{simpl}$ behaves like an ordinary modifier and allows for substitution of extensionally equivalent expressions $\text{salva veritate}$. From that, we can conclude that it takes arguments of type $e$.

In CS-08, we try to find a common semantic core for $amazing_{simpl}$ and $amazing_{expl}$ that fits both ordinary individuals and (index-dependent) kinds/degrees. We spell it out as the metalanguage predicate $AMAZING$. It picks out the set of worlds that fulfill

12Following the convention in Heim and Kratzer (1998), the domain restriction is indicated between a colon that follows the $\lambda$-bound argument variable and the dot preceding the value.
all the speaker’s expectations and expresses that a certain \( x \) has different properties there from what properties \( x \) has in the actual world.\(^{13,14}\)

\[
\text{AMAZING}(w)(x) := \forall w' \in \text{Exp}_{w,\text{Speaker}}(w)[\{P | P_{w'}(x)\} \neq \{P | P_w(x)\}]
\]

According to the generalization in (18), for \textit{amazing}_{\text{simpl}}, \( x \) has to be of type \( e \) (that is, it can combine with ordinary individuals, kinds or degrees). For \textit{amazing}_{\text{expl}}, \( x \) has to be of type \( \langle s, e \rangle \) and meet the DUALTYPE-requirement introduced above, that is, either it is a degree assigning individual concept, or it is a kind assigning individual concept.

This accounts for the substitution patterns observed in (7) vs. (8): \textit{amazing}_{\text{simpl}} allows for substitution \textit{salva veritate} of extensionally equivalent expressions, while \textit{amazing}_{\text{expl}} does not. The infelicity of DPs that are rigid kind or degree denoting expressions can be explained in terms of blocking by \textit{amazing}_{\text{simpl}}.

Of course, ‘having different properties’ from what is expected looks like a straightforward account for why an individual (or a particular kind) is amazing. Yet, it may not obvious why ‘having different properties’ should give rise to the reading of degrees/kinds being different ones at the actual index of evaluation vs. at all worlds conforming to the speaker’s expectations. At least certain neurotic properties have to be excluded by stipulation. For degrees, we argue that the properties in question are always of the sort of what \( x \) instantiate the gradable property to degree \( d \) at a given world, which entails that we are talking about a different degree.\(^{15}\) Hence, for degree referring expressions like \textit{the height of this building}, \textit{amazing}_{\text{simpl}} and \textit{amazing}_{\text{expl}} are predicted to come out as synonymous, which might look satisfactory at first glance.

\section{The monotonicity problem}

The analysis in CS-08 looks promising as it captures the empirically established restrictions on the argument of \textit{amazing}_{\text{expl}} in a natural way and predicts the facts about index (in)dependence. Yet, there is reason to worry.

A maybe minor problem is related to the analysis in terms of sets of differing properties. Already with \textit{amazing}_{\text{simpl}} we face the problem that not any old property should be taken into account. Apart from notoriously neurotic properties (e.g. being situated in a particular world \( w' \)), more innocent looking ones have to be banned as well. From (30-a) it follows that the property ‘\( \lambda w \lambda x. \text{people think in } w \text{ that } x \text{ is weird} \)’ holds of John, but was not expected to. Yet, (30-b) need not be true.\(^{16}\)

\[
(30) \quad \begin{align*}
\text{a.} & \quad \text{It’s amazing that people think John is weird.} \\
\text{b.} & \quad \text{John is amazing.}
\end{align*}
\]

\(^{13}\)Several people have pointed out that \textit{amazing} is not the same as \textit{surprising}. Maybe expectations should be replaced by stereotypical assumptions. As far as I can tell, the point is not crucial to my concerns here.

\(^{14}\)In order to have such a fully uniform core for \textit{amazing}_{\text{simpl}} and \textit{amazing}_{\text{expl}}, we have to allow a shift from \( x \) to the corresponding constant individual concept.

\(^{15}\)Note that it gives rise to technical complications with \textit{amazing}_{\text{simpl}}.

\(^{16}\)Independently, Rett (2008b) acknowledges her analysis to be besieged by this problem, too (p.152, fn 7). But not only speaker evaluative properties cause problems.
Worse, the analysis has to resort to **monotonicity** in order to avoid overgeneration. Consider (31).

(31) It’s amazing the height of this house.

In CS-08 we discuss the worry that our semantics for amazing\textsubscript{expl} might predict (31) to be true because something other than the house is higher than expected. Assume that we do not have strong feelings about the height of this house, yet, we would have expected the church to be lower than the house. In fact, they are of the same height, namely \(d_{30}\). In this scenario, the height of this house denotes different degrees at various expectation worlds, but at each of these worlds, it picks out a higher degree than the height of this church does. Therefore, at all expectation worlds \(w’\), the property \(\lambda w \lambda d. (\text{church}, w) \in d\) does not hold of the degree \(d’\) that is picked out by the height of this house in \(w’\). Yet, at the actual world \(w@\) this property does apply to the actual height of this house \(d_{30}\). In CS-08, we argued that this needs to be blocked because amazement involves monotonicity. The intuition that monotonicity should play a role here is certainly correct. But instead of evoking monotonicity as an external principle to save the analysis, we need to derive it as a property of the amazing\textsubscript{expl}-construction.

If (31) is true, we conclude that any higher degree would be a source of amazement as well. But not all occurrences of amazing(ly) are subject to this constraint (cf. Morzycki, 2004; Katz, 2005; Nouwen, 2005). Consider a scenario like (32) (along the lines of Morzycki, 2004):

(32) **scenario:** this house was built in 1865; due to heavy weather conditions, the soil got very wet and the building sunk a bit; we measure its ’new’ height and discover it to be exactly 18m65cm.

Clearly, in this scenario, the height of the house has a puzzling property, roughly ’\(\lambda w \lambda d. \text{name of its height } d \text{ in meters is the building date of the house in } w’\); nevertheless, there is not expectation that the house should have been lower. Consequently, only non-monotone expressions are acceptable in the given scenario. Acceptability in a scenario like (32) induces the following classification:

(33) a. The house is amazingly high. \hspace{1cm} \textit{montone}
   b. Amazingly, the house is high. \hspace{1cm} \textit{non-monotone}
   c. The height of the house is amazing. \hspace{1cm} \textit{non-monotone}
   d. It’s amazing the height of this house. \hspace{1cm} \textit{montone}

Note that despite our original intuitions, the interpretation of amazing\textsubscript{simpl} and amazing\textsubscript{expl} differs for degree properties: amazing\textsubscript{simpl} does not give rise to monotonicity of expectations (cf. Morzycki (2004)), but amazing\textsubscript{expl} does.
5 Solving the monotonicity problem

5.1 The disjunction

Given the above considerations, CS-08’s account needs to be revised. For the moment, I give up the quest for a common AMAZING-core and adopt a more straightforward analysis of amazing\textsubscript{simpl}. According to (34), it expresses unexpected behavior w.r.t. a particular contextually salient property \( P \).

\begin{equation}
[\text{amazing}\textsubscript{simpl}] = \lambda w \lambda x . \exists P [ P \text{ contextually salient} \& P_w (x) \& \forall w' \in \text{Exp}_{w,\text{Speaker}} [ \neg P_w (x) ]].
\end{equation}

Returning to our original intuitions for amazing\textsubscript{expl} (‘the height/kind/... is a different one than what we expected it to be’), (35) looks like the most straightforward interpretation.

\begin{equation}
[\text{amazing}\textsubscript{expl}] = \lambda w \lambda x : \text{DUALTYPE}(x). \forall w'' \in \text{Exp}_{w,\text{Speaker}} [ x (w'') \neq x (w) ].
\end{equation}

Indeed, the predictions look good for the kind reading:

\begin{equation}
\text{It’s amazing the kind of marine life that you will experience on a Galapagos vacation.}
\end{equation}

\begin{equation*}
\approx \text{At all speaker-stereotypical worlds you experience a different kind of marine life.}
\end{equation*}

Nevertheless, for the degree case the analysis fails just like CS-08’s property analysis. With (35), we have assimilated (37-a) to (37-b). But while the first is monotone, the second is not.

\begin{equation}
\begin{aligned}
\text{a. It’s amazing the height of this house.} \\
\text{b. It’s amazing that this house has the height it actually has.}
\end{aligned}
\end{equation}

Even if we have unified the type of the argument DP (thanks to CS-08’s condition of DUALTYPE), we cannot come up with a strictly uniform value: degrees come with an order and require instantiation to a smaller degree (cf. (38)), kinds do not come with such an order and require simple inequality as in (35).

\begin{equation}
[\text{amazing}\textsubscript{expl}] = \lambda w \lambda x : \text{DUALTYPE}(x). \forall w'' \in \text{Exp}_{w,\text{Speaker}} [ x (w'') < x (w) ].
\end{equation}

Of course, this is not a nice result. An attractive way out would be to come up with a nested construal of kinds, much along the lines of what we find with degrees.\footnote{I’d like to thank Chris Potts (p.c.), who suggested to look for a solution along these lines.} At the moment, I do not see how to make it work. I will thus leave the re-ordering of kinds for further research. Instead, I will resort to a somewhat more conservative strategy arising from comparison of the account in CS-08 with the treatment of \textit{wh}-exclamatives and nominal exclamatives in Rett (2008a,b).
5.2 Kinds induce slots for gradable properties

Rett (2008a) does not talk about amazingexpl, but she deals with main clause wh-exclamatives, inversion exclamatives and nominal exclamatives. Remember that nominal exclamatives obey the same restrictions as DPs embedded under amazingexpl (cf. section 2). Following assumptions in the literature, Rett assumes that surprise as expressed in exclamatives can only target (extreme) degrees. A wh-exclamative like (39) can be appropriate because (i) Mimi speaks a high amount of languages (the amount reading), or because (ii) Mimi speaks very exotic languages. It cannot express that Mimi speaks two particular languages different from what the speaker had expected (but without independently surprising properties).

(39) (My,) What languages Mimi speaks!

The possible readings are exactly those observed for amazingexpl. Yet, in CS-08 and above, reading (ii) is described as targeting the kind of languages Mimi speaks. In contrast, Rett (2008a) calls it the gradable reading. She assumes that the gradable reading requires the presence of a contextually given gradable property \( \mathbb{P} \) (here: being exotic) which holds to an unexpectedly high degree. Her argument runs as follows: how-questions are in principle ambiguous between asking for manner or for evaluation, cf. (40).

(40) How does Buch ride his horse?
   a. manner: bare-backed, saddled, . . .
   b. evaluation: beautifully, dangerously, clumsily, . . .

Only evaluations are gradable. For the corresponding exclamative in (41) only the evaluation reading is available, which follows if exclamatives can only be about degrees, but not about non-gradable things like manners (or kinds).

(41) (My), How Buck rode his horse!

From this, Rett (2008a) concludes that all exclamatives express surprise with respect to an extreme degree. The semantics is spelt out in terms of an illocutionary force operator that constrains expressive adequacy. Note that Rett (2008a) assumes exclamatives to denote degree properties. For me, at an index, the height of this house would pick out the maximal degree to which the house is high; for her, it would select the set of degrees \( d \) such that the house is \( d \)-high.

(42) \(\text{DEGREE E-FORCE}(D_{(d,(s,t))})\) is expressively correct in context \( C \) iff \( D \) is salient in \( C \) and \( \exists d \cdot d > c_{\text{standard}}[\text{the speaker is surprised that } \lambda w . D(d)(w)]^{20} \)

\(^{18}\)Cf. references in Rett (2008b).

\(^{19}\)Note that this holds only for a formally identifiable class of exclamatives. Declarative clauses like Sue wore orange shoes! can be used as exclamations (i.e., expressions of surprise) without being subject to such a constraint.

\(^{20}\)In contrast to Katz (2005) and Nouwen (2005), Rett (2008b) assumes that exclamatives require not only instantiation to a degree above the expectations, but also to a degree above the contextual standard. I find her arguments convincing.
Consequently, the putative kind readings have to be construed as gradable readings thanks to a contextually given gradable property $\mathbb{P}$. As Rett (2008a) herself observes, the distribution of such covert gradable properties is far from clear. In particular, unlike the amount reading she derives from another silent predicate QUANTITY, they have no parallel with (headed) relative clauses.

But this turns out to be a severe problem. NEs obey the same restrictions as amazing$_{\text{expl}}$-DPs, hence, they have to contain a degree NP, or a relative clause. But nothing in Rett (2008a)'s analysis predicts the infelicity of (43-a) in contrast to (43-b) (which carries over to the corresponding amazing$_{\text{expl}}$-clauses). Her framework does nothing to prevent the insertion of a contextually given gradable property $\mathbb{P}$ which would save (43-a).$^{21}$

(43) a. #The people from Italy!
   b. The people who come from Italy!
In order to have our cake and eat it, I propose the following: Rett (2008a) is right in that amazement is always about degrees and not about kinds directly. But $\mathbb{P}$ can only appear with kind-referring expressions. Hence, two steps are necessary to obtain the kind/gradable-reading of (39): first, the relative clause generates kind of languages s.t. Mimi speaks languages of that kind, then, a contextually given gradable property can be inserted. Given that, the entry for amazing$_{\text{expl}}$ can be simplified to (44) while still predicting the restrictions observed.

(44) $[\text{amazing$_{\text{expl}}$}] = $
\lambda w \lambda x_se : \forall w' P[x(w')] = \text{DEG}(P), \forall w'' \in \text{Exp}_{w,\text{Speaker}}[x(w'') < x(w)].

In the absence of a relative clause, neither QUANTITY nor $\mathbb{P}$ can apply and (43-a) fails to denote a degree property/individual concept.

6 Conclusion

The proposal in CS-08 spells out the correct restrictions on what DPs can occur in expletive emotive constructions like it's amazing. Nevertheless, our uniform semantics for kinds and degrees fails to cope with the monotonicity properties that are observed with degree readings, but are inapplicable to kinds. In order to maintain a uniform account, I follow Rett (2008a) in treating putative kind readings as degree readings that involve covert gradable properties. Yet, in order to predict what DPs can appear under it's amazing or as NEs, I maintain the assumption that relative clauses are needed for shifts to amounts and kinds, and I argue that covert gradable properties can only be inserted with kinds.

$^{21}$Note that QUANTITY cannot apply: it is independently motivated to combine with two properties $(\lambda P \lambda d \lambda Q. \exists X[P(X) \land Q(X) \land \text{measure}(X) = d])$, so the relative clause is needed to fill the second property argument. A similar two-place semantics for the covert gradable properties would be at odds with their other occurrences and their inability to occur in headed relative clauses.
Acknowledgements

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References


Maximize Presupposition! and Informationally Encapsulated Implicatures

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Abstract
This paper attempts to overcome certain objections to the idea that Maximize Presupposition! (Heim 1991) is reducible to the theory of implicature.

1 Introduction

Heim’s (1991) Maximize Presupposition! (henceforth MP) states, roughly, that given two contextually equivalent alternatives, speakers must use that alternative whose presuppositions are stronger and happen to be met in the context of use. Given our common knowledge that there is exactly one sun, for example, the principle accounts for why # A sun is shining is such an odd sentence; the speaker should have used The sun is shining instead. The principle is technically sound, and fully predictive. The puzzle facing us is a conceptual one: why should language use be constrained by such a principle?

The goal of this paper is to explore the extent to which MP might be reduced to more general principles. More specifically, my goal is to explore the extent to which MP might be reducible to the theory of scalar implicature. Heim (1991) suggested a way to derive MP effects from implicature reasoning, but concluded that the context-dependence of this reasoning prevented the reduction from succeeding. In response to this, Magri (To Appear) noted that if the system that computes implicatures can be prevented from accessing contextual information, Heim’s derivation can go through unencumbered. However, even with modularity assumptions in place, Magri argued (from new data that he discovered) that the reduction is not possible, concluding that a separate principle will be needed. I will attempt to defend the reduction against these objections.
2 MP as Global, Pragmatic Competition

Consider the contrasts below:

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

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

Take the contrast in (1), for instance. How would MP account for it? We should begin by setting up some background assumptions.

First, let us assume the following lexical entries for the articles:

**Lexical Entry 1 (The Definite Article)**

\[ [[X]Y] \text{ expresses that proposition which is: (a) true at index } i \text{ if there is exactly one } X \text{ at } i, \text{ and it is } Y \text{ at } i, (b) false at } i \text{ if there is exactly one } X \text{ at } i, \text{ and it is not } Y \text{ at } i, (c) truth-valueless at } i \text{ if there isn’t exactly one } X \text{ at } i \]

**Lexical Entry 2 (The Indefinite Article)**

\[ [[a(n)X]Y] \text{ expresses that proposition which is true at index } i \text{ iff there is at least one individual at } i \text{ that is both } X \text{ at } i \text{ and } Y \text{ and } i. \]

We also assume the following definition of ‘contextual equivalence,’ borrowed from Sauerland (2003) and Schlenker (2006):

**Definition 1 (Contextual Equivalence)**

\[ \text{LFs } \phi \text{ and } \psi \text{ are contextually equivalent with respect to context } c \text{ iff } \{ w \in c : [[\phi]](w) = 1 \} = \{ w \in c : [[\psi]](w) = 1 \} \]

Let us return now to our contrast in (1). First note that our common knowledge entails that there is exactly one sun. As such, given our definition of contextual equivalence, it turns out that (1a) and (1b) end up being contextually equivalent. If there is exactly one sun in every world of evaluation, both (1a) and (1b) are true in the same worlds in the context, namely those worlds where this one sun is shining. But if both LFs serve the same communicative function (i.e. map the same input context to the same output context), why should (1a) be odd, while (1b) is perfectly felicitous?

The contrast was first noted in Hawkins (1978). He used it to argue that definites are subject to an ‘inclusiveness’ condition and indefinites to an ‘exclusiveness’ condition, by which was meant simply that the N can only be used if there is exactly one N in the context, and a(n) N can be used only if there are many N in the context. Heim (1991) presents crucial evidence against the exclusiveness condition for indefinites. For instance, the following sentence does not presuppose that there are at least two 20 ft. catfish:

\[1^{\text{From Chemla (2007) and Magri (To Appear).}}\]

\[2^{\text{One diagnostic for this is that you can’t felicitously apply the Hey Wait a Minute! Test (von Fintel 2004) here: # Hey wait a minute! I didn’t know there are multiple 20 ft. catfish! See also Sauerland (2008) for relevant discussion.}}\]
3. Robert caught a 20 ft. catfish

Heim proposes instead that only the definite is presuppositional (cf. our lexical entries above). In addition, she suggests that there must be a principle in force urging us to use \([\text{the } X] \ Y]\) instead of \([\text{a(n) } X] \ Y]\) in contexts where the presuppositions of the former are met. She speculates that perhaps a maxim guiding us to make our conversational contributions presuppose as much as possible might generally be operative in communication. Sauerland (2003, 2008), Percus (2006), and Schlenker (2006) generalize and formalize Heim’s speculative remarks. Sweeping certain irrelevant differences in their formulations under the rug, here, roughly, is a statement of MP that is (I believe) faithful to the intentions of all these works, which I’ll call ‘Standard MP:’

**Standard MP: MP as Global, Pragmatic Competition** If \(\phi, \psi\) are contextually equivalent alternatives, and the presuppositions of \(\psi\) are stronger than those of \(\phi\), and are met in the context of utterance \(c\), then one must use \(\psi\) in \(c\), not \(\phi\).

This statement presents Standard MP as a solution to an optimization problem: Given a set of competing LFs that all update the current context \(c\) to a new output context \(c'\), Standard MP determines that the best LF for carrying out this update is the one with the strongest presupposition satisfied in \(c\). The reader will no doubt have noticed that the statement of Standard MP makes reference to an unanalyzed notion of ‘alternatives.’ To make the principle precise, therefore, it is necessary to spell out what this space of competing alternatives is. Much like work on scalar implicature, it has been thought that certain lexical items trigger MP competitions, and that the items themselves rest on certain scales. These scales have generally had to be stipulated. However, they are the only point at which stipulation is allowed. Once given, they can be used to mechanically derive the space of competing LFs. In our examples, for instance, the following lexical scales would need to be available: \(< \text{a, the } >, < \text{all, both } >\). These can multiply more generally: \(< \text{believe, know } >, \text{etc.}\).³

**Alternatives for Standard MP** If \(< \alpha, \beta >\) is a scale, and \(\phi\) is an LF containing lexical item \(\alpha\), and \(\psi\) is an LF that is everywhere like \(\phi\) except that at some terminal node it contains \(\beta\) where \(\phi\) contains \(\alpha\), then \(\phi\) and \(\psi\) are alternatives.

With this machinery in place, let us return now to our contrast in (1). As discussed above, given that it is common knowledge that there is exactly one sun, both sentences are true in the same worlds in the context. They are also alternatives to one another under the above definition. Furthermore, since the presupposition of (1b) (that there is exactly one sun) is met in the context of use, Standard MP requires that the speaker use (1b), rather than (1a). By uttering (1a), the speaker will have blatantly violated this principle of language use, generating the peculiar kind of oddness we detect upon hearing it. Technically, all seems well. The question is: why should language use be constrained by a principle like MP?

³Much like with scalar implicatures, it would be better if one had an intensional characterization of the alternatives. I believe that such a characterization can be provided using Katzir’s (2007) procedure for generating scalar alternatives. For ease of exposition here, I will simply assume the more familiar scalar approach.
3 On Deriving MP

Heim (1991) writes that ‘it would be desirable to derive [MP] from general principles of some sort...[MP] reminds one at first glance of the phenomenon of scalar implicature.’ She then asks us to imagine how scalar implicatures might be used to generate MP like effects. She focusses on the articles. Under the classical interpretation of indefinites and definites assumed here, the latter asymmetrically entail the former. Thus, assertion of [[(a(n) X) Y] generates the implicature that the speaker doesn’t believe [[t he X] Y]. Thus, if the speaker believes the content of her assertion, the conclusion is that the speaker doesn’t believe (by implicature) that there is exactly one X. In the case of A sun is shining, the implicature would be that the speaker doesn’t believe that there is exactly one sun. Since this contradicts common knowledge, the result is odd.

Having derived the essential effect for us, Heim goes on to argue that the derivation will not succeed. The basis of her skepticism lies in the pragmatic nature of scalar implicatures. For example, since it is common knowledge that there is exactly one sun, the indefinite and the definite contribute the same new information to the context. As such, scalar reasoning doesn’t apply, since the maxim of quantity is made inert by the contextual equivalence of the scalar alternatives. Hence the required implicature cannot be generated.

Schlenker (2006), reporting on a personal communication from Emmanuel Chemla, presents some compelling evidence suggesting that the effect of MP might nonetheless follow from scalar implicatures, for the same effect seems to come up with scalar alternatives that carry no relevant presuppositions (so that MP, if operative at all, would be irrelevant to such cases):

4. John assigned the same grade to all of his students. He gave an A to {all / #some} of them.

As in Heim’s argument, we see that when the scalar implicature contradicts common knowledge, the result is distinctly odd. In (4), the second sentence is evaluated with respect to a context updated by the information conveyed by the first sentence. The implicature that John gave an A to some but not all of his students contradicts the contextually entailed information that John assigned the same grade to all of his students.

But what of Heim’s argument concerning the inapplicability of scalar reasoning? Given the Chemla-Schlenker observation, we might be led to believe that the difficulty lies not in the application of scalar reasoning to MP phenomena, but in the theory of scalar implicature itself. Indeed, working within a theory of scalar implicature whereby implicatures are computed within the grammar (eg. Chierchia 2004, Fox and Hackl

\footnote{For this to be true under a presuppositional analyses of definites one needs to assume that if a sentence S presupposes \( p \), then it also entails \( p \). Most theories abide by this assumption, though some do not (eg. Karttunen and Peters 1979). I will assume in this paper that presuppositions are indeed also entailed.}

\footnote{See Footnote 11 for a sample computation. I ignore for now issues of primary versus secondary implicatures. ! See Sauerland (2004) and Fox (2007) for recent discussion. I return to the epistemic status of this implicature towards the end of the paper (Section 4, cf. also Chemla 2008, Sauerland 2008).}

\footnote{The more general idea is, of course, that use of sentence \( \phi \) will be odd if it gives rise to an implicature that contradicts common knowledge. We will return to this more general idea in just a few moments.}

\footnote{Percus (2006) and Sauerland (2008) make a similar argument.}
2006, Fox 2007, Chierchia, Fox, and Spector 2008), Magri (To Appear) develops a general theory of oddness along lines envisioned by Heim (1991), one that readily accounts for the oddness of sentences like (4). My claim here is that Heim’s derivation of MP from scalar implicature also goes through if one adopts Magri’s theory of oddness. Let me say a bit about the latter.

3.1 Mismatches and Oddness

Magri (To Appear) develops and defends at length the idea that scalar implicatures are computed on the basis of *semantic* asymmetric entailment relations, without access to contextual information, such as that there is only one sun, etc. He calls this the Blindness Hypothesis (since the implicature system is ‘blind’ to common knowledge):

**Blindness Hypothesis (BH)** Implicatures are computed over the output of semantics without access to contextual information.

BH can be implemented in several different ways. For concreteness, we’ll assume that given the proposition denoted by the asserted sentence \( \phi \), and a set \( C \) of alternative propositions (the propositions denoted by the scalar alternatives of \( \phi \)), \( \neg \psi \) will be a blind scalar implicature of \( \phi \) if only if:

1. \( \psi \in C \)
2. \( \psi \) entails \( \phi \)
3. \( \phi \land \neg \psi \) is consistent.

Magri also generalizes Heim’s observation concerning the interaction of scalar implicatures and common knowledge by defending a principle from Hawkins (1991) that he calls the **Mismatch Hypothesis** (MH). MH states that whenever a (blind) scalar implicature contradicts common knowledge, the result is a sensation of oddness:

**Mismatch Hypothesis (MH)** If the blind scalar implicatures of the asserted sentence contradict common knowledge, the result is odd.

As Magri points out, BH and MH together (I’ll write this as BH/MH from now on) correctly predict the oddness of the Chemla-Schlenker sentence (4). He further shows that BH/MH can be used to account for a host of complex properties concerning individual level predicates, such as the following sentence is odd (inter alia):

5. #John is sometimes tall

The above sentence generates the implicature that John isn’t always tall, which contradicts our common knowledge that *tallness* is a permanent property. I refer the reader to Magri’s paper for many further applications of BH/MH.

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8 For further arguments in favour of the Blindness Hypothesis, see Fox and Hackl (2006), Chierchia, Fox, and Spector (2008).

9 Our notation does not distinguish between sentences and the propositions they denote, but the reasoning works over content, not form.

10 Various considerations require this statement to be modified (cf. Groenendijk and Stokhof 1984, van Rooij and Schulz 2004, Spector 2006, Fox 2007), but these complications need not detain us at this point.
3.2 Mismatches and MP

The claim I wish to defend here is that BH/MH is all that is needed to derive MP:

Claim: Maximize Presupposition! follows as a consequence of BH/MH.

I will try to argue that Heim’s argument goes through unencumbered so long as implicature computation is divorced from contextual reasoning. For note that what prevented Heim’s derivation from succeeding was the idea that the implicature system had access to common knowledge, since it (the implicature system) was thought to be pragmatic. Related to contextual information, it could deduce that the two sentences contribute the same new information to the context. However, if implicatures are computed within the grammar, hence encapsulated from common knowledge, the implicature system cannot make this deduction. Working with semantic information alone, the sun is shining asymmetrically entails a sun is shining, and the desired implicature can thus be computed.\[11\]

But why am I putting this forth as a claim here if it’s an obvious consequence of BH/MH? The reason is that Magri, having defended these principles, presents new data suggesting that MP might not actually be derivable from them. Consider contrasts like the following (from Magri (To Appear)):

6. Context: Every child inherits the last name of their father.
   (a) # Every child of Couple C has a French last name
   (b) The children of Couple C have a French last name

Magri suggests that the oddness of (6a) should be related to the oddness of (1a) (# A sun is shining) and (2a) (# All of John’s eyes are open). To use BH/MH, first, we need a competitor to (6a). Magri proposes that (6b) is a scalar alternative of (6a). This is derived by assuming that <every, the> is a Horn scale. Second, he argues that due to certain properties of distributive predication with plural definites, (6b) has a homogeneity presupposition that (6a) lacks, viz. that either every child of Couple C has a French last name or none of them do. Thus, (6b) has a stronger presupposition than (6a). Despite this, the two sentences end up semantically equivalent, both conveying the proposition that every one of the children of Couple C has a French last name.\[12\] As such, even under the assumption that implicatures are computed blindly, when (6a) is uttered there is no relevant implicature that can be generated in order for MH to be applicable. The oddness of (6a) is hence left unaccounted for, at least if BH/MH are the only operative principles. Magri concludes from this difficulty that the difference in presuppositional strength between (6a) and (6b) should be held responsible for the oddness of the former.

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11[\(\![a(n)X]Y] \text{ is true in a set of worlds } E \text{ where there exists an individual that is both an } X \text{ and a } Y.\]
12[\(\![\text{the } X]Y] \text{ is true in that subset of } E \setminus U, \text{ where there is a unique individual that is an } X, \text{ and that that unique individual is also a } Y.\] A blind implicature thus generates the proposition \(E \setminus U\). When common knowledge entails \(U\), the result is odd (under MH).

This example differs in important ways from examples like (1)/(2) in that (6b) has the curious property of being a sentence whose asserted meaning (that every child of Couple C has a French last name) entails its presupposed meaning (that either every child of Couple C has a French last name or no child of Couple C does).
He thus needs a principle that is sensitive not to the semantic content of the alternatives, but to their presupposed content alone. The technical innovation involves formulating a Blindness Hypothesis and a Mismatch Hypothesis for presuppositions, BHP and MHP. These principles work separately from the Blindness Hypothesis and the Mismatch Hypothesis for semantic content. Very roughly, these principles use the same objects as BH/MH (the scalar alternatives of the sentence), and the same method of computing inferences, but instead of working with the propositions denoted by the alternatives, they use the projected presuppositions of the alternatives. More specifically, under BHP, the grammatical system considers the presuppositions of the scalar alternatives, and for those alternative presuppositions that are stronger than those of the asserted sentence, the system concludes (blindly) that they are false. Call such inferences blind implicated presuppositions to distinguish them from the outputs of BH (blind scalar implicatures).

In addition, under MHP, if these blind implicated presuppositions contradict common knowledge, the result is odd (in parallel with BH/MH).

With BHP and MHP in place, the oddness of (6a) can be derived. When (6a) is asserted, the system computes (by BHP) that the homogeneity presupposition of (6b) is false, i.e. it infers that some but not all of the children of Couple C have a French last name. But this of course contradicts the common knowledge that all the children of Couple C have the same last name, and (given MHP) the sentence is destined to be odd.

Thus, we have four principles, BH and MH for semantic content, and BHP and MHP for presuppositional content. Independent of Maximize Presupposition! related facts, we have seen evidence (eg. the Chemla-Schlenker sentences like (4)) that something like BH/MH is needed. We saw furthermore that BH/MH can in fact be extended to the cases we started out with (examples (1) and (2)), as desired, but, as observed by Magri, they have nothing to offer in accounting for the oddness of (6a). This fact led Magri to propose that the linguistic system also incorporates principles like BHP and MHP, principles sensitive solely to presupposed information. This move, in effect, concedes that MP cannot be reduced to standard implicature reasoning (BH/MH). However, I believe that the introduction of BHP/MHP should be met with some caution. For note that BHP/MHP introduce a redundancy in the theoretical account of standard MP facts (eg. (1) and (2)), in that their oddness now has two distinct explanations, one deriving from BH/MH, and the other from BHP/MHP. The apparent need for BHP/MHP arises only under the assumption that the oddness of (6a) is indeed related to the oddness of (1a) and (2a). If so, one needs an account in terms of alternatives, and, as argued by Magri, (6b) presents just the right kind of alternative. Against this idea, I will present evidence that (6a) and (6b) cannot be alternatives. If the argument is sound, then the oddness of (6a) probably has a different source. I will suggest that this source is a separate pragmatic constraint governing felicitous discourse, and will try to present evidence that such a constraint is needed on independent grounds. To the extent that the argument is correct, (6a) will no longer stand as a barrier to the reduction of MP to BH/MH.

3.3 No Escape from Oddness: Alternatives and Relevance

There are four prima facie worries about the assumption that (6a) and (6b) are alternatives. First, one would have to make sense of the fact that the subjects in the alternatives
differ in number (singular versus plural). Second, assuming that the distributive operator $DIST$ is represented at LF, (6b) would not be an alternative to (6a) under Katzir’s (2007) theory of alternatives, for it is strictly more complex than (6a).\footnote{In the normal case, Katzir allows only those LFs that are at most as complex as the asserted sentence to be alternatives to it.} If it is indeed better to have an intensional characterization of the alternatives than a stipulative one, and if Katzir’s arguments in favour of his particular characterization are sound, this might be problematic. Third, scalar alternatives are normally ordered by asymmetric entailment, whereas (6a) and (6b) are in fact equivalent. Fourth, members of a scale are normally the same semantic type. It is not at all clear that every and the can be thought to satisfy this condition.

Putting these worries aside, I think that there is a good diagnostic for probing whether two hypothesized alternatives actually are alternatives. Let’s consider the basic MP effect again. The current proposals argue that the oddness of the asserted sentence $\phi$ arises because $\phi$ generates a scalar implicature that contradicts common knowledge. But if that’s the account, there seems to be an obvious escape hatch: given the optionality of implicature computation, why not simply exploit this optionality to avoid or cancel the offending inference?

Magri (To Appear) proposes a very interesting response. He argues that in the cases under consideration the escape hatch is actually unavailable, i.e. that the implicatures in such cases are mandatory. He locates the cause of the mandatoriness in the contextual equivalence of the alternatives. By virtue of having been asserted, $\phi$ can be assumed to be relevant. But since $\phi$ and $\psi$ are contextually equivalent, under the assumption that relevance is contextually determined, it is natural to conclude that $\psi$ will also be relevant. Assuming furthermore that a scalar alternative must be relevant if it is to be considered in implicature reasoning (eg. Gamut 1991), then $\psi$ will necessarily be included in the reasoning, and the implicature will be mandatory. This accounts for why there is no escape from the oddness of sentences like (1a), (2a), (6a), and others like them.

Returning now to the issue of disputed alternatives, the above reasoning makes a clear prediction. Suppose we have reason to believe $\phi$ and $\psi$ are alternatives (and $\psi$ is stronger along some dimension of interest), but are unsure whether they in fact are. The above reasoning provides a way to at least determine a negative answer: if we can find contexts in which $\phi$ and $\psi$ are equivalent, but in which $\phi$ is NOT odd, then it can’t be that $\phi$ and $\psi$ are alternatives (since there should be no escape from oddness). Returning to the question of whether (6a) and (6b) are actually alternatives, consider the following dialogue:\footnote{Irene Heim, p.c.}

7. Q: Who here has a French last name?
(a) Well, John, Mary, every child of Couple C, my neighbours
(b) Well, John, Mary, the children of Couple C, my neighbours

The fact that there is no oddness to (7a) in the way there is with (6a) suggests that <every, the> is not really a scale at all. The reasoning that leads to the conclusion
that (1a), (2a), (4), and the like are necessarily odd also leads to the conclusion that (6a) should necessarily be odd. Note that the reasoning itself seems correct. For example, putting (6a) as part of a list answer obviates its oddness, but the same trick does not work in cases like (4), where the existence of a scale like \(<\text{some, all}>\) is generally taken to be true:

8. Context: John gave the same grade to all his students.
   Q: Who got an A this year?
   A: Well, half of Ms. Smith’s class, some of John’s students, and all of Mary’s students

Other attempts to obviate the oddness of (6a) can readily be found, while the oddness of (4) seems mandatory, as predicted by Magri’s assumptions about relevance and mandatoriness. These facts in turn question the status of principles like BHP and MHP. If (6a) is not competing with (6b), then something else must be behind its oddness.

I would like to suggest that (6a) is odd because it tends to be read with focus on every, which, for whatever reason, suggests it is being offered as an answer to the question, How many children of Couple C have a French last name? And in the given context, this is an odd question to raise. It is odd even if asked overtly in such a context. It seems to be odd for the reason that Magri offered, namely, it suggests (in contradiction with common knowledge) that the names of the children of Couple C might well not be the same. However, Magri’s account of the oddness in terms of competition with an alternative that grammatically encodes a homogeneity presupposition seems to be unable to make sense of the fact that the oddness disappears in certain contexts (cf. (6)-(8)). I am offering the alternative hypothesis that the oddness of (6a) instead has to do with broader discourse level concerns (eg. what makes certain questions appropriate in certain contexts). If this approach is on the right track, we expect to find an oddness similar to (6a) if we introduce the same information as (6a) by using a different linguistic form that probably does not generate alternatives with homogeneity presuppositions, but which nonetheless suggests (because of focus placement) that it is an answer to the odd question How many children of Couple of C have a French last name?. For example, suppose it is common knowledge that Couple C has five children:

9. (a) # FIVE children of Couple C have a French last name
   (b) # The number of children of Couple C with a French last name is FIVE

The alternatives to (9a) are presumably of the form \{n children of Couple C have a French last name: n \in \mathbb{N}\}, while the set of alternatives to (9b) is presumably \{The number of children of Couple C with a French last name is n : n \in \mathbb{N}\}. I do not see how a competition based account like BHP/MHP could be extended to these cases.

These facts suggest that there is a maxim of language use that might be stated in something like the following terms:15

Maintain Uniformity! Do not introduce questions into the discourse that have possible answers (qua cells of a partition, eg. Groenendijk and Stokhof 1984) that contradict common knowledge of uniformity of some set!

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15Of course, it is to be hoped that this maxim follows from more general principles.
I am suggesting that, given the facts in (7)-(9), BH/MH along with the above maxim are better predictors of the data discussed in this paper than the combination of BH/MH and BHP/MHP. Crucially, both BH/MH and Maintain Uniformity! seem to receive support from cases where there are no presuppositions involved that seem directly related to MP (eg. (4), (9)). Ideally, nothing else should be needed. We might thus examine whether this proposal has any consequences for some of the other facts discussed by Magri. Although our discussion here will have to be limited, consider, for example, the oddness of the following (cf. also (5)):

10. # John is always tall

Magri argues that (10) competes with a structure that is like (10) except it contains a GEN operator in place of always. He proposes that these structures are alternatives. Now, although the two structures are semantically equivalent (both conveying the proposition that John is always tall), the structure with GEN introduces a homogeneity presupposition that (10) lacks (that either John is always tall, or he never is). It thus presupposes more than (10) and, therefore, would be odd under BHP/MHP. However, if (10) has a structure with GEN in place of always as an alternative, there should be no way for it to escape oddness, given our earlier discussion about Magri’s (apparently correct, cf. (8)) assumptions about relevance and the mandatoriness of implicatures. But even here, it seems that the oddness of (10) is much reduced by asking the right kind of question. Consider the following dialogue, for instance:

11. Q: What property does John always have?
   Well, he’s always tall, for one.

   The above is funny, though not quite as odd as (10). It is funny in the same way that the answer, Well, he’s always identical with himself might be funny. It is funny because it is entirely uninformative. But it doesn’t feel odd in the way that (10) feels odd. If this judgment is correct, then we must reject the assumption that the LF with always and the one with GEN are alternatives at all. Instead, the oddness of (10) might better be explained as a violation of Maintain Uniformity! The sentence seems to me to be offered as an answer to a question like, How often is John tall, or Who is always tall? (depending on focus marking). Forcing the hearer to accommodate such a question into the discourse violates Maintain Uniformity!.

Let me try to summarize where we are. The goal of this paper was to try to argue that Maximize Presupposition! can and should be eliminated from the basic inventory of linguistic principles. In so doing, we attempted to show that Heim’s (1991) attempted derivation could go through by adopting a grammatical theory of implicature (the Blindness Hypothesis) along with the Mismatch Hypothesis (Hawkins 1991, Fox and Hackl 2006, Magri 2007). We were met with the counterexample of (6a), which cannot be accounted for by BH/MH. This (and other facts, eg. (10)) led Magri (To Appear) to formulate a new pair of principles (BHP/MHP) that essentially end uprestating MP. Magri defended his analysis over an intricate, non-trivial set of data, and I cannot do full justice to that work in the space allotted to me here. Limiting ourselves to the data discussed in this paper, I have argued that BH/MH and Maintain Uniformity! provide a better account of these facts than BH/MH and BHP/! MHP. But with this we seem to be back at
the problem we started with: we seem to have gotten rid of Maximize Presupposition! well enough, but we’ve replaced it with another principle we don’t understand, Maintain Uniformity!. Given the facts in (6)-(11), the latter would seem to be needed anyhow (in place of BHP/MHP), and (4) teaches us that we need BH/MH. Since BH/MH also captures (1)/(2), we should enrich the theory beyond BH/MH and Maximize Uniformity! only if necessary. If the preliminary investigations here can be further supported, we will have gone some way toward simplifying the inventory of linguistic principles.

4 More Concerns About the Reduction of MP to Implicatures

Suppose that the cases of MP discussed above (eg. (1), (2)) can indeed be reduced to the theory of implicature (BH/MH). The prospects for a more general reduction of MP facts to implicature would still be faced with at least three difficulties.

First, the epistemic status of the implicatures predicted by the system assumed here are ‘secondary implicatures,’ i.e. of the form ‘it is certain that not p’ (cf. Footnote 11). For example, sentences with an indefinite are currently predicted to generate the implicature that the speaker is certain that the presupposition of the definite does not hold. However, Sauerland (2008) has argued that such implicatures have the weaker status of primary implicatures, i.e. of the form ‘it is not certain that p.’ He argues that this difference in epistemic status is one reason to think that these inferences are due to a mechanism that is different from the one responsible for scalar implicature.

Second, Percus (2006) discovered a class of sentences that carry identical presuppositions, and are semantically equivalent, and yet still undergo something very much like an MP competition. For example, (12a) and (12b) both presuppose nothing (under standard theories of presupposition projection, eg. Karttunen and Peters 1979, Heim 1983, Schlenker 2007), and are truth-conditionally equivalent, but (12b) seems to be blocking (12a) nonetheless:

12. (a) # Every teacher with exactly two students gave them all an A
    (b) Every teacher with exactly two students gave them both an A

Neither a Gricean, context-sensitive implicature system, nor a grammatical, context-blind one that operates over semantic propositions, seems capable of delivering the required implicature here, since (12a) and (12b) denote the same proposition.

Third, if MP effects were due to implicature computation, we would need to make sense of the fact that unlike run of the mill cases of implicatures (eg. (13b)), the implicature shows up in downward entailing environments (eg. (13a)):

13. (a) # A sun isn’t shining
    (b) John didn’t eat beef or pork at the party

The second sentence does not (without marked intonation) generate the implicature that John ate beef and pork at the party (= ¬(¬(B ∧ P))). However, if (13a) is
to be accounted for by BH/MH, we would need the implicature (that the speaker is uncertain that there is exactly one sun) to be generated here, despite the DE environment (and the lack of marked intonation). Sauerland (2008) has cited this divergence in DE environments as yet a further reason to keep MP and the theory of implicature apart.

Despite these objections, I believe each of these difficulties can be overcome. The second difficulty can be overcome if implicatures are computed by a ‘supermodular’ system, one that operates over logical forms that are stripped of all non-logical information. More precisely, the level of representation that’s needed is a structure in which all non-logical symbols are replaced by variables, but whose logical terms remain visible. Evidence that the semantic system employs such a level of representation is given in Gajewski (2004), and Fox and Hackl (2006) argue (from different data) that such a level is the one used by the implicature system. If their arguments are correct, then the oddness of (12a) would be readily predicted. The first and third difficulties can be overcome by adopting revisions to the theory of implicature that I’ve argued elsewhere (Singh 2008) are needed independently to solve certain problems that arise in the theory of presupposition (cf. the proviso problem of Geurts 1996). Support for these assertions will have to wait for a future occasion.

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References


Counterfactuality and Future Time Reference: The Case of Paraguayan Guaraní –mo’ā

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Abstract
Paraguayan Guaraní has a verbal suffix –mo’ā that realizes future time reference in one type of clause and counterfactuality in another. This paper explores the truth-conditional semantics of –mo’ā in the two types of clauses and identifies parallels and differences between counterfactual and future time interpretation. The paper concludes by discussing the feasibility of a unified analysis of –mo’ā.

1 Introduction

The Paraguayan Guaraní (henceforth Guaraní) verbal suffix –mo’ā occurs in clauses with future time reference and clauses with a counterfactual interpretation. Which interpretation arises depends on the position of –mo’ā with respect to the circumfix n(d)(a)–...–i, which expresses sentential negation. The example in (1), where –mo’ā is inside the negation circumfix, has future time reference whereas the examples in (2), where –mo’ā occurs in a positive sentence (2-a) or outside of the circumfix (2-b), receive a counterfactual interpretation (translated with almost).¹

(1) Nd-a-ha-mo’ā-i Paraguaý-pe.
NEGA1-go-MOA-NEG Asunción-to
‘I will not go to Asunción.’ [E]

¹Guaraní is spoken by about four million people in Paraguay and surrounding countries. The data presented here were collected during yearly fieldwork from 2004 to 2008. The Guaraní examples are given in the standardized orthography of Guaraní used in Paraguay (Ministerio de Educación y Cultura 2004, cf. also Velázquez-Castillo 2004, 1421f.), except that all postpositions are attached to their host. Following the official orthography, accents are not written for normally accented words (stress on the final syllable); stressed nasal syllables are marked with a tilde. Examples are marked to identify their origin; elicited examples are marked with [E], examples from a corpus of naturally occurring texts with [C]. The following glosses are used: 3 = 3rd person, A/B 1/2/3 sg/pl = set A/B 1st/2nd/3rd person singular/plural, COMPLETE = completive aspect, DEM = demonstrative, DIM = diminutive, EMPH = emphatic, FUT = future marker, incl = inclusive, JE = reflexive/passive, NEG = negation, NOM = nominalizer, PERF = perfect aspect, PL = plural, PROG = progressive, RC = relative clause.

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After introducing relevant aspects of the temporal and modal system of Guaraní in §2, the paper explores the truth-conditional semantics of –mo’ā in these two kinds of clauses in §3 (future time interpretation) and §4 (counterfactual interpretation). In these sections, the suffix is semantically analyzed as mo’ā₁ and mo’ā₂, respectively, i.e. as if the suffix was ambiguous. Whether a unified analysis is possible is discussed in §5.² (The suffix is glossed as ‘–MOA’ throughout the paper.)

2 Basics of Guaraní temporality and modality

Verb stems in Guaraní are obligatorily inflected for person and number with one of two sets of cross-reference markers (set A and set B, cf. e.g. Gregores and Suárez (1967) for details). The majority of verbs in natural discourse are only marked for person/number; in matrix clauses, these unmarked verbs are compatible only with a realis (non-future) interpretation, as illustrated in (3) and (4). The unmarked verb o-ke ‘A3-sleep’ in (3-a) has present time (and progressive aspectual) reference, whereas the unmarked verbs o-heja ‘A3-leave’ and o-ho ‘A3-go’ in (3-b) are interpreted at the past reference time of the given context. Guaraní has no present or past tense morphemes.

(3) a. Context: Maria returns from her daughter’s room and reports:
   Rossáni o-ke.
   Rossani A3-sleep
   ‘Rossani is sleeping.’
   [overheard]

b. Context: A woman had a child out of wedlock.
   B3-child o-heja ha o-ho mombyry.
   A3-leave and A3-go far
   ‘She left her child and went far away.’
   [C]

Unmarked verbs in matrix clauses cannot cooccur with future time adverbs such as ko’öro ‘tomorrow’ in (4-a) and are incompatible with modal subordination contexts, as in (4-b):

(4) a. #Ko’öro a-purahei.
    tomorrow A1sg-sing
    (Intended: Tomorrow I will sing.)
    [E]

²Guaraní has a verb stem mo’ā ‘think’ that is homophonous with the suffix under discussion here. Whether the verb stem and the suffix are diachronically related is an open question.
b. Context: I’m hungry. Somebody tells me:

Re-‘u-vara pete pehengue sópa. #Ne-ryvatā./Ne-ryvata-ta.
A2sg-eat-must one piece corn.bread A2sg-full/A2sg-full-FUT
‘You should eat a piece of corn bread. #You are full./You’d be full.’ [E]

Verbs marked with –mo‘ā are part of a verbal paradigm that includes, in addition to unmarked verbs, verbs suffixed with the future marker –ta ‘–FUT’, the modal markers –se ‘–want’, –ne ‘–might’ and –va’erā ‘–must’ and the aspectual markers –ma ‘–PERF’ and –pa ‘–COMPLETE’ (see Gregores and Suárez (1967), Liuzzi and Kirtchuk (1989), and Tonhauser (2006) for details).

3 Future time reference with –mo‘ā

As mentioned above, –mo‘ā realizes future time reference when it is realized inside the negation circumfix n(d)(a)–...–i, cf. also (5-a). Future time reference in positive clauses is generally expressed with the suffix –ta ‘–FUT’, as in (5-b):

(5) a. Nd-a-ha-mo‘ā-i Paraguaý-pe. (= (1))
   NEG-A1sg-go-MOA-NEG Asunción-to
   ‘I will not go to Asunción.’ [E]

   A1sg-go-FUT Asunción-to
   ‘I will go to Asunción.’ [E]

The truth-conditional meaning of the suffix –ta is analyzed in detail in Tonhauser (2009). This section illustrates that clauses where –mo‘ā occurs (morphologically) inside the negation circumfix (henceforth referred to as ‘NEG-mo‘ā-clauses’) have the same temporal and modal properties as positive clauses with –ta (modulo negation). I analyze this meaning of –mo‘ā as mo‘ā1.

3–ta can express future time reference with negated clauses, especially with embedded clauses, when it occurs outside the negation circumfix: (ia), for example, is as acceptable as (ib). In matrix clauses, however, my consultants strongly prefer (5-a) over (iia); (iib) is ungrammatical.

(i) a. Juan he‘i ché-ve Maria nd-o-u-i-ta-ha araka‘eve.
   Juan A3.say B1sg-to Maria NEG-A3-come-NEG-FUT-NOM never
   ‘Juan told me that Maria will never come.’ [E]

b. Juan he‘i ché-ve Maria nd-o-u-mo‘ā-i-ha araka‘eve.
   Juan A3.say B1sg-to Maria NEG-A3-come-MOA-NEG-NOM never
   ‘Juan told me that Maria will never come.’ [E]

    NEG-A1sg-go-FUT Asunción-to
    ‘I will not go to Asunción.’ [E]

b. *Nd-a-guapý-ta-i.
    NEG-A1sg-sit-FUT-NEG
    (Intended: I will not sit down.) [E]
3.1 Future time reference

A first property shared by clauses with –ta and NEG-mo’ã-clauses is that they entail future time reference. All 77 sentences with –ta in a corpus of naturally occurring data have future time reference, additional texts did not reveal examples where –ta does not express future time reference, and attempts to elicit such examples failed (Tonhauser 2009). Likewise, the 13 NEG-mo’ã-clauses in my corpus have future time reference, and additional texts did not reveal examples that did not have future time reference.

As expected, clauses with –ta and NEG-mo’ã-clauses are compatible in out-of-the-blue contexts (i.e. where the reference time is the utterance time) only with future time adverbs (6), not with past time ones (7):

(6)  a. Ko’êro o-ky-ta.
    tomorrow A3-rain-FUT
    ‘Tomorrow it will rain.’ [E]

   b. Ko’êro nd-o-ky-mo’ã-i.
    tomorrow NEG-A3-rain-MOA-NEG
    ‘Tomorrow it will not rain.’ [E]

(7)  a. #Kuehe o-ky-ta.
    yesterday A3-rain-FUT

   b. #Kuehe nd-o-ky-mo’ã-i.
    yesterday NEG-A3-rain-MOA-NEG

But the temporal reference of neither type of clause is restricted to deictic future time reference: in past contexts such as those in (8), both can realize future time reference relative to a past reference time.

(8)  a. Context: A mother tells about her experiences with taking care of her daughter’s wound: “I was the one who cleaned her wound…”

    Priméra ve a-hechá-ta hîña.
    first time A1sg-see-FUT PROG

     ‘I would be seeing it [her wound] for the first time.’ [C]

   b. Context: A mother reports on what the doctor said upon inspecting her daughter’s wound.

    Upé-rire he’i-ma-ramo chupe la ne-o-pei’aatõ-mo’ã-i-ha la that-after A3:say-PERF-then 3.to the NEG-A3-open-MOA-NEG-NOM the punto ichupe.
    stitch 3.to

    ‘And then he said to her that he would not open her stitches.’ [C]

---

4 The corpus is a collection of nine texts from different genres (fables, personal narratives, conversation), and consists of about 7,300 Guaraní words (which correspond to about 20,000 English words since Guaraní is mildly polysynthetic).
In sum, clauses with –\textit{ta} and \textit{NEG-mo’\text{ä}-}clauses entail (relative) future time reference. The next section discusses the modal attitudes that are conveyed by these future sentences.

### 3.2 Modal attitudes: intention and prediction/expectation

Both –\textit{ta} and –\textit{mo’\text{ä}} convey future time reference with the modal attitudes of intention and prediction/expectation. Utterances with the modal attitude of intention convey an agent’s mental state of intending to make a proposition be true at a time in the future; the intender is committed to do what s/he can to make the proposition true. The examples in (9) illustrate this modal attitude:

(9) a. Context: A woman is scheming on how to catch the monkey that is playing tricks on her. She says:
   \begin{quote}
   A-japó-\textit{ta} ta’anga araity kakuaa porā-va. \\
   A1sg-make-FUT figure wax big pretty-RC
   \end{quote}
   ‘I will make a pretty big wax figure.’ [C]

b. Context: A woman invites her visitor to sit down. The visitor replies:
   \begin{quote}
   Nd-a-guapy-\textit{mo’\text{ä}-i} che-ama, sapy’a-ite-mínte a-ju. \\
   NEG-A1sg-sit-MOA-NEG B1sg-lady quickly-very-DIM-only A1sg-come
   \end{quote}
   ‘I will not sit down, my lady, I only came for a little while.’ [C]

In (9-a), the woman expresses her intention to make a wax figure and, in (9-b), the speaker expresses the intention of not sitting down.

With predictions, the speaker asserts that the proposition will be true at a time in the future: the speaker conveys that, given her/his epistemic state, s/he is committed to the truth of the proposition at a future time. Unlike with intention, no commitment or implication of agency is necessarily associated with prediction. Expectations are a weaker kind of prediction: the speaker does not assert but conveys a strong conviction that, given her/his epistemic state, the proposition is true at a future time. In the examples in (10) the two modal markers are interpreted with the modal attitude of prediction/expectation:

(10) a. Context: A father is happy that his daughter will come back home.
   \begin{quote}
   Hasypevé-ko péina o-je-arreglá-\textit{ta} ko asúnto. \\
   finally-EMPH DEM A3-JE-resolve-FUT this matter
   \end{quote}
   ‘Finally this matter will get resolved.’ [C]

b. Context: A teacher says to a student who has badly hurt her hand:
   \begin{quote}
   Na-ne-katu-\textit{mo’\text{ä}-i} re-eskribi. \\
   NEG-B2sg-possible-MOA-NEG A2sg-write
   \end{quote}
   ‘You will not be able to write.’ [C]

The speaker of (10-a), for example, asserts that, given his epistemic state, the matter (of his unmarried daughter not living at home) will be resolved.
The modal attitudes are formally analyzed as restrictions on the worlds quantified over by \(-ta\) and \(-mo'\text{\textDia}\), using Kratzer’s (1991) theory of modality. Intention involves a circumstantial modal base and an ordering source that specifies the agent’s intentions, and prediction/expectation involves an epistemic modal base and a stereotypical ordering source (see Tonhauser (2009) for details).

3.3 Counterfactual implicature with \textit{kuri} ‘back then’

The Guaraní adverb \textit{kuri}, translated as ‘back then’, is used in natural discourse to locate eventualities at a previously mentioned past time (see Tonhauser 2006, §7.3). I analyze \textit{kuri} ‘back then’ as a past time anaphor. In out of the blue contexts, the past time is accommodated; an unmarked verb like \textit{o-ke} ‘A3-sleep’ that occurs with \textit{kuri} ‘back then’ receives a deictic past time interpretation.

\begin{equation}
(11) \quad \text{Rossáni o-ke } \textit{kuri}.
\end{equation}

\begin{equation}
\text{Rossáni A3-sleep back.then}
\end{equation}

‘Rossáni slept.’ (Not: Rossáni is sleeping.) \[E\]

The suffixes \textit{–ta} and \textit{–mo’\text{\textDia}} are compatible with \textit{kuri} ‘back then’; such combinations give rise to an implicature that the eventuality denoted by the verb was not realized. Evidence for this counterfactual implicature is that consultants will spontaneously volunteer continuations that convey that the eventuality was not realized. Consider (12), and its continuation in (12-a):

\begin{equation}
(12) \quad \text{Context: Malena saw the weather report two days ago.}
\end{equation}

\begin{equation}
\text{Kuehe o-ky-} \textit{ta} \quad \textit{kuri}.
\end{equation}

\begin{equation}
\text{yesterday A3-rain-FUT back.then}
\end{equation}

‘It was going to/supposed to rain yesterday.’ \[E\]

\begin{itemize}
\item a. \text{...ha nd-o-ky-i.}
\text{...and NEG-A3-rain-NEG}
\text{‘...but it didn’t rain.’} \[\text{spontaneously volunteered}\]
\item b. \text{...ha o-ky.}
\text{...and A3-rain}
\text{‘...and it rained.’} \[E\]
\end{itemize}

Evidence that the counterfactual implication is merely an implicature comes from the fact that (12) can also be felicitously continued with (12-b), which states that the eventuality was realized.

\begin{equation}
\text{In (13), kuri ‘back then’ occurs in a NEG-mo’\text{\textDia}-clause. Here, the implication arises that Juan went to Buenos Aires (cf. (13-a)):
}\end{equation}
(13) Context: Juan’s sister invited Juan to visit her in Buenos Aires. He told me he wouldn’t go. I say:

Juan nd-o-ho-mo’á-i kuri Buéno Áire-pe.
Juan NEG-A3-go-MOA-NEG back.then Buenos Aires-to

‘Juan wasn’t going to go to Buenos Aires.’ [E]

a. ... hákatu o-ho.
   but A3-go
   ‘...but he went.’ [E]

b. ... ha nd-o-hó-i.
   and NEG-A3-go-NEG
   ‘...and he didn’t go.’ [E]

Again, the fact that (13-b), too, is a felicitous continuation of (13) shows that the counterfactual implication is merely an implicature.

3.4 Interim summary and analysis

In sum, positive clauses with –ta and NEG-mo’á-clauses share the following temporal and modal properties:

1. They entail relative future time reference.
2. Temporal adverbs constrain the temporal location of the future eventuality.
3. Only future time adverbs are acceptable in out-of-the-blue contexts (i.e. in contexts where the reference time is the utterance time); past time adverbs are acceptable in past contexts and with kuri ‘back then’.
4. They are compatible with the modal attitudes of intention and prediction.
5. They implicate counterfactuality with the past-time temporal anaphor kuri.

Given these similarities between the two types of clauses (modulo negation), it is plausible to explore the hypothesis that –ta and –mo’á contribute the same meaning to their respective clauses. Tonhauser (2009) analyzes –ta as a future marker with a modal meaning component:

(14) The meaning of –ta:

–ta presupposes an epistemic modal base with a stereotypical ordering source or a circumstantial modal base with a ordering source that specifies the agent’s intentions. If defined:

\[ \text{–ta} \Rightarrow \lambda P_{(\omega, (1,t))} [\forall w'(w' \in \text{best}(MB, OS, \langle w, rt \rangle) \rightarrow \exists t'(rt < t' \land P(w')(t'))]] \]

The suffix –ta applies to sentence radicals P, which denote functions from worlds (type \( \omega \)) to functions from times (type t) to truth values. Following Kratzer (1991), the modal base MB and the ordering source OS are contextually provided; the three-place operator ‘best’ (borrowed from Portner (1998)) denotes those worlds in the modal base MB that are closest to the ideal according to the ordering source OS at the index \( \langle w, rt \rangle \) (both w and rt (reference time) are designated variables).
Assume somebody utters (15-a) out of the blue (i.e. the reference time is the utterance time) while staring into a sky with many dark clouds. The translation of –ta combines with the translation of the sentence radical o-ky ‘A3-rain’ (15-b), which denotes the set of world-time pairs (indices) at which it rains. This results in the translation in (15-c) for (15-a):

A3-rain-FUT
‘It will rain’ [E]
b. Sentence radical: o-ky ‘A3-rain’ =⇒ λwλt[rain′(t, w)]
c. ∀w′(w′ ∈ best(MB, OS, ⟨w, rt⟩) → ∃t′(rt < t′ ∧ rain′(t′, w′)))

According to (15-c), (15-a) is true at the actual world w₀ and the utterance time now if and only if in all worlds w that are best with respect to an epistemic modal base and a stereotypical ordering source at ⟨w₀, now⟩ there is a time t′ in the future of the utterance time at which it rains in w′.

Now consider (16-a), also uttered out of the blue and while staring into a dark and cloudy sky. If the suffix –mo’ā here has the same meaning as –ta, we have to assume that –mo’ā semantically outscopes negation even though it (morphologically) is inside the negation circumfix. (I discuss this morphology-semantics mismatch below.) The negated sentence radical nd-o-ky-i ‘NEG-A3-rain-NEG’ denotes the set of indices at which it does not rain (16-b). The meaning of –mo’ā is mo’ā₁, i.e. (14). Applying this to (16-b) results in (16-c).

(16) a. Nd-o-ky-mo’ā-i.
NEG-A3-rain-MOA-NEG
‘It will not rain’ [E]
b. nd-o-ky-i ‘NEG-A3-rain-NEG’ =⇒ λwλt[¬rain′(t, w)]
c. ∀w′(w′ ∈ best(MB, OS, ⟨w, rt⟩) → ∃t′(rt < t′ ∧ ¬rain′(t′, w′)))

According to (16-c), (16-a) is true at w₀ and now if and only if in all worlds w that are best with respect to an epistemic modal base and a stereotypical ordering source at ⟨w₀, now⟩ there is a time t′ in the future of the utterance time at which it does not rain in w′. (This reading is too weak, cf. Partee (1973); I assume that this could be amended by assuming that t′ is contextually given and not existentially bound in the scope of the modal.)

The morphology-semantics mismatch is a problem for this analysis since there is independent evidence that morphological structure indicates semantic scope. This is illustrated in (17) for the necessity modal –va’erā ‘–must’. In (17-a), where –va’erā ‘–must’ occurs inside the negation circumfix, negation has wide scope (¬□); in (17-b), on the other hand, the marker occurs outside the circumfix and has scope over negation (□¬). (Other verbal suffixes that show this pattern are –ne ‘–might’, –ve ‘–more’ and –se ‘–want’.)

Now consider (18-a), also uttered out of the blue and while staring into a sky with many dark clouds. If the suffix –mo’ā here has the same meaning as –ta, we have to assume that –mo’ā semantically outscopes negation even though it (morphologically) is inside the negation circumfix. (I discuss this morphology-semantics mismatch below.) The negated sentence radical nd-o-ky-i ‘NEG-A3-rain-NEG’ denotes the set of indices at which it does not rain (16-b). The meaning of –mo’ā is mo’ā₁, i.e. (14). Applying this to (16-b) results in (16-c).
(17) a. Context: A child complains that the teacher doesn’t do his homework for him. The father says:
Nde-mbo’ehára na-ne-pytyvō-va’erä-i.
B2sg-teacher NEG-B2sg-help-must-NEG
‘Your teacher doesn’t have to help you.’ [E]

b. Context: A child doesn’t know how to do anything alone because the teacher always helps him do things. The father says:
Nde-mbo’ehára na-ne-pytyvō-i-va’erä.
B2sg-teacher NEG-B2sg-help-NEG-must
‘Your teacher must not/should not help you.’ [E]

Given the correlation between surface order and semantic scope observed with other verbal suffixes, an analysis of NEG-mo’ā-clauses where negation outscopes the meaning of the suffix would be preferable. I return to this in §5.

4 Counterfactual interpretations with –mo’ā

As mentioned in §1, clauses where –mo’ā does not appear inside the negation circumfix, henceforth ‘mo’ā-clauses’, receive a counterfactual interpretation: the eventuality denoted by the (non-)negated verb to which –mo’ā attaches is implied to have almost been realized in the actual world, but not quite. Accordingly, Guaraní consultants often translate such examples using Spanish casi ‘almost’.

(18) a. Context: A girl runs towards a door to prevent being locked out.
O-ñe-mboty-mo’ā hese puértə.
A3-JE-close-MOA to.3 door
‘The door almost closed for her (but it didn’t).’ [C]

b. Context: The airline informs Marco that his flight to Mexico was cancelled. As he is getting ready to return home, the airline tells him that they found a seat on another flight, and he goes to Mexico.
Márko nd-o-ho-i-mo’ā Méhiko-pe.
Marco NEG-A3-go-NEG-MOA Mexico-to
‘Marco almost didn’t go to Mexico (but he went).’ [E]

(18-a) expresses that at some past time the prediction (or expectation) arose that the door would close, but at the utterance time the door is not closed. With (18-b) the speaker reports a past expectation that Marco would not go to Mexico but also conveys that he did in fact go. Thus, both examples imply that the eventuality denoted by the (non-)negated verb was not realized; I refer to this as the counterfactual implication of mo’ā-clauses.
4.1 Counterfactuality is entailed

I argue in this section that the counterfactual implication of mo’ā-clauses is an entailment. Evidence that it is not merely an implicature comes from examples like (19) where the second conjunct is infelicitous in the context of the first.

(19) a. Context: Juan had a very bad accident.
O-mano-mo’ā #ha o-mano.
A3-die-MOA and A3-die
(Intended: He almost died and he died.) [E]

b. Context: Juan and Martin are presidential candidates.
La hente-kuéra oí-poravo-mo’ā Martín-pe #ha oí-poravo Martín-pe.
the people-PL A3-chose-MOA Martin-to and A3-chose Martin-to
(Intd.: The people almost chose Martin and they chose Martin.) [E]

The second conjunct in both examples denies the non-realization of the eventuality denoted by the first conjunct. In (19-b), for example, the first conjunct implies that Martin was not chosen (but Juan) and the second conjunct, which states that Martin was chosen, is not felicitous. Since the counterfactual implication cannot be cancelled, it is not an implicature (compare this to the examples in §3.3).

If the counterfactual implication of mo’ā-clauses were a presupposition, we would expect it to project in linguistic contexts that function as holes to presuppositions, such as the antecedents of conditionals (20-a) or modals (20-b). (Sentential negation is of course not a suitable test here since NEG-mo’ā-clauses receive a future time interpretation.)

(20) a. Context: Juan is participating in a competition. The person who reaches the top of Mount Everest wins a prize as well as the person who comes close to the top. We are waiting at the bottom and can’t see what’s going on at the top because of the clouds. Somebody says:
O-guahē-mo’ā-rō Juan huā-me o-ganā-ma prémi, pero che
A3-reach-MOA-if Juan B3.top-to A3-win-PERF prize but B1sg
a-pensa o-guahē-ha huā-me.
B1sg-think A3-reach-NOM B3.top-to
‘If Juan almost reached the top, he already won a prize, but I think he reached the top.’ [E]

b. Context: Malena is in Asunción to participate in a running competition. Nobody of her family is accompanying her. On the day of the race, we’re all in her parents’ house to wait for her to call us after the race. Her kid brother is very impatient and keeps asking whether she won or not. Somebody snaps at him:
O-gana-mo’ā-ne, o-perdé-ne ha o-ganá-ne!
A3-win-MOA-might A3-lose-might and A3-win-might
‘She might have almost won, she might have lost and she might have won!’ [E]
If the counterfactual implication was a presupposition, we would expect these utterances to be infelicitous. Take (20-a). The antecedent of the conditional implies that Juan has not reached the top. If this implication was a presupposition, it should also be a presupposition of the entire conditional. The context given for (20-a), however, makes clear that Juan not reaching the top is not in the common ground (since the people at the bottom of the mountain cannot see what’s going on). Evidence that the purported presupposition is not accommodated comes from the fact that the continuation pero che a-pensa o-guahê-ha huâ-me ‘but I think he reached the top’ would be infelicitous with the accommodated presupposition — yet the entire discourse in (20-a) is felicitous. Hence, the counterfactual implication is not a presupposition, but an entailment. Likewise, (20-b) should be infelicitous if the implication that Malena did not win was presupposed by the first conjunct.

4.2 Temporal properties

A striking difference between NEG-mo’ã-clauses (§3) and mo’ã-clauses is their temporal reference. When interpreted at the utterance time, as in the context of (21), the former receive a future time interpretation (21-a), while the latter receive a past interpretation (21-b).

(21) Context: Laura had an accident and we are very concerned about her.
   a. N-o-mano-mo’ã-i. 
      NEG-A3-die-MOA-NEG
      ‘She will not die.’                     [E]
   b. O-mano-mo’ã. 
      A3-die-MOA 
      ‘She almost died (but she didn’t).’    [E]

In the given context, the speaker uses (21-a) to predict Laura’s not dying in the future of the utterance time. (21-b), on the other hand, expresses that at the contextually relevant past time (the accident) there was an expectation that Laura would die (but she didn’t, in the end). Thus, while both examples involve a prediction/expectation about a future time, this time is in the future of the utterance time in (21-a) but in the future of a past time in (21-b).

As expected then, mo’ã-clauses are compatible with past time adverbs in out-of-the-blue contexts (in contrast NEG-mo’ã-clauses, cf. (7-b)):

(22) a. Kuehe o-ky-mo’ã. 
    yesterday A3-rain-MOA 
    ‘It almost rained/was supposed to rain yesterday (but it didn’t).’  [E]
   b. Ambue mé-pe Márko nd-o-ho-i-mo’ã Méhiko-pe other month-at Marco NEG-A3-go-NEG-MOA Mexico-to 
    ‘Last month, Marco almost didn’t go to Mexico (but he went).’  [E]
The temporal adverbs in these examples constrain the times at which the eventualities were predicted or intended to occur. In (22-a), for example, the temporal adverb *kuehe* ‘yesterday’ constrains the time at which it was supposed to rain.

*mo‘ā*-clauses are also compatible with future time adverbs, such as *ko‘erō* ‘tomorrow’. In (23), the eventuality was intended to be realized in the future of the utterance time, at a time within tomorrow.

(23) Context: The speaker was scheduled to sing the next day but the concert was cancelled.

    Ko‘erō a-purahei-mo‘ā.
    tomorrow A1sg-sing-MOA
    ‘Tomorrow I would have sung (but I won’t).’

Thus, the counterfactual interpretation does not depend on the intended (or predicted) eventuality not having occurred in the past. Rather, what is crucial is that there is a past time at which there is an intention (or prediction), and, at the utterance time, it is known that the actual world is not a world in the proposition comes true.

4.3 Towards a formal analysis

In sum, *mo‘ā*-clauses have the following temporal and modal properties:

1. They entail that there is a time in the past of the utterance time at which there is an intention or prediction for the eventuality denoted by the verb to occur at a time in the (relative) future.
2. They entail counterfactuality, i.e. that the eventuality denoted by the verb is not realized at the intended or predicted time in the actual world.
3. Temporal adverbs constrain the temporal location of the intended/predicted counterfactual eventuality. In out-of-the-blue contexts, the counterfactual eventuality is located in the past of the utterance time (and hence they are compatible with past time adverbs) but future time adverbs are also acceptable.

To illustrate, imagine (24) being uttered by a disgruntled farmer:

(24) Kuehe o-ky-mo‘ā.
    yesterday A3-rain-MOA
    ‘It was supposed to rain yesterday (but it didn’t).’

(24) is true at the utterance time if and only if there is a time $t$ in the past of the utterance time at which there is a prediction that it rains at a time $t’$ in the (relative) future of $t$ and that $t’$ is in the denotation of *kuehe* ‘yesterday’. Additionally, as depicted informally in (25), (24) asserts that it did not rain in the actual world $w_0$ (but only in worlds $w_1$ that were like $w_0$ at least until $t$).
Since the temporal adverb kuehe ‘yesterday’ (26-a) constrains the temporal location of the counterfactual eventuality, it combines with the sentence radical o-ky ‘A3-rain’ (26-b) to give the translation in (26-c). I analyze the meaning of the suffix –mo’ā in mo’ā-clauses as mo’ā2: the translation of –mo’ā in (26-d) applies to (26-c) to give (26-e), which is the meaning of (24).

(26) a. kuehe ‘yesterday’ =⇒ λP⟨ω,⟨ι,t⟩⟩[P(w)(t) ∧ t ⊆ yesterday]
b. Sentence radical o-ky ‘A3-rain’ =⇒ λwλt[rain′(w)(t)]
c. λwλt[rain′(t,w) ∧ t ⊆ yesterday]d. –mo’ā =⇒ λP⟨ω,⟨t,r⟩⟩[∃t′(t′ < now ∧ ∀w′(w′ ∈ best(MB,OS,⟨w,t′⟩))

→ ∃t″(t′ < t″ ∧ P(w′)(t″) ∧ ¬P(w)(t″)))]
e. ∃t′(t′ < now ∧ ∀w′(w′ ∈ best(MB,OS,⟨w,t′⟩))

→ ∃t″(t′ < t″ ∧ t″ ⊆ yesterday ∧ rain′(t″,w′) ∧ ¬rain′(t″,w′)))

(24) is true if and only if there is a time t′ before the utterance time such that in all worlds that are best with respect to an epistemic modal base and a stereotypical ordering source at ⟨w₀,t′⟩ there is a time t″ (in the future of t′ and included in yesterday) at which it rains, and it does not rain at t″ in the actual world w₀.

5 Is a unified analysis of –mo’ā possible?

In Table 1, I compare the truth-conditional meanings of NEG-mo’ā- and mo’ā-clauses. (FTR stands for ‘future time reference’ and TADV for ‘temporal adverb’.)

<table>
<thead>
<tr>
<th></th>
<th>NEG-mo’ā-clauses</th>
<th>mo’ā-clauses</th>
</tr>
</thead>
<tbody>
<tr>
<td>FTR entailed relative to...</td>
<td>reference time</td>
<td>time before now</td>
</tr>
<tr>
<td>Modality: intention, prediction</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Counterfactuality</td>
<td>implicated with kuri</td>
<td>entailed</td>
</tr>
<tr>
<td>Compatible w/ future TADV?</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Compatible w/ past TADV?</td>
<td>in past contexts/with kuri</td>
<td>✓</td>
</tr>
</tbody>
</table>

Table 1: Comparison of NEG-mo’ā-clauses and mo’ā-clauses

NEG-mo’ā- and mo’ā-clauses share temporal and modal properties, which is reflected in the underlined part of the meanings mo’ā₁ and mo’ā₂: both involve relative future time reference and the modal attitudes of intention and prediction.

(27) a. mo’ā₁: λP⟨ω,⟨t,r⟩⟩[∀w′(w′ ∈ best(MB,OS,⟨w,r⟩))

→ ∃t′(rt < t ∧ P(w′)(t′))]}
Key differences between the two interpretations are the following. First, the counterfactual interpretation \textit{mo'\texttilde{a}$_2$} involves an additional (past) time at which the best worlds are determined; hence \textit{mo'\texttilde{a}}-clauses are compatible with past time adverbs in out of the blue contexts, in contrast to \textit{NEG-mo'\texttilde{a}}-clauses. Second, while both types of clauses entail that the eventuality is not realized, this results from \textit{mo'\texttilde{a}$_1$} combining with sentential negation and from the counterfactual entailment of \textit{mo'\texttilde{a}$_2$}. Third, while \textit{mo'\texttilde{a}}-clauses entail counterfactuality, \textit{NEG-mo'\texttilde{a}}-clauses only implicate it in the presence of \textit{kuri} ‘back then’, just like clauses with \textit{–ta}.

Is a unified analysis of the suffix possible? What is striking is that the two interpretations of \textit{–mo'\texttilde{a}} are in complementary distribution: \textit{–mo'\texttilde{a}} is interpreted as \textit{mo'\texttilde{a}$_1$} when it appears inside the negation circumfix and as \textit{mo'\texttilde{a}$_2$} when it does not. (Of all the suffixes that can occur both inside and outside the negation circumfix, only \textit{–mo'\texttilde{a}} exhibits distinct interpretations depending on its position with respect to the circumfix.) A unified analysis of the suffix might capitalize on the idea that it is the relative scope of negation that results in the two interpretations: the meaning of \textit{–mo'\texttilde{a}} would need to be specified such that the future time interpretation results from negation scoping over the suffix (which is desirable on independent grounds, cf. §3.4), and the counterfactual interpretation arises from \textit{–mo'\texttilde{a}} not being in the scope of negation. Differences might also be attributable to context dependent elements in the meaning of \textit{–mo'\texttilde{a}}, such as the modal base. Future research will have to determine the feasibility of this line of inquiry.

**Acknowledgements**

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Comparatives Combined with Additive Particles:
The Case of German *noch*

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Abstract
This paper investigates comparatives combined with the German particle *noch* ('still'). Such comparatives trigger – in some but not all contexts – the entailment that the comparison base exceeds the standard of the comparison class, which is surprising since comparatives in general are assumed to be insensitive to the standard of the comparison class. It is shown that the entailment results from the fact that comparatives combined with *noch* are anaphoric. An interpretation is proposed which accounts for the fact that comparative *noch* is both scalar and additive.

1 Introduction
It is well-known that the unmodified positive form of a gradable adjective relates to a contextually given standard of comparison. Thus (1) entails that Berta is taller than some standard given by, e.g., the class of ten-year old girls. Following Bierwisch (1989) constructions relating to a contextually given standard of comparison will be called norm-related in this paper. The unmodified comparative form of a gradable adjective is clearly not norm-related – the sentence in (2) neither entails that Adam is tall nor that Berta is tall. Surprisingly, the comparative form seems to be norm-related when combined with the particle *noch* ('still'). The sentence in (3a), if presented out of the blue, entails that Adam, and thus Berta are tall. Similarly, from (3b) it will be concluded that the old web pages of the advertising company were customer-friendly and informative. There are, however, also contexts where the comparative form combined with *noch* is not norm-related. In (4a), for example, it is not entailed that the male brain is big, and in (4b) it is not entailed that the range of activities of physiotherapists was large at the end of the last year.
First of all, the above examples raise the question of why the comparative construction turns out to be norm-related when combined with the particle noch. How does noch affect the comparative to yield this effect? Secondly, what is the role of the context? Why do the contexts in (4a,b) prevent norm-relatedness? Thirdly, there is the question of what the particle noch in (3) and (4) means. The use of noch in (3) and (4) will be called the comparative use of noch in this paper. Assuming that this use of noch does not constitute a separate reading, how does it relate to the other uses of noch?

In the literature, the comparative use of noch is widely ignored. In the field of comparison, side remarks can be found, for example in Bierwisch (1989) and Varnhorn (1993), acknowledging the fact that comparative noch may cause norm-relatedness. Prominent papers on the particle noch, e.g. Löbner (1989), Krifka (2000), disregard the comparative use, with the exception of König (1977), who makes an elegant proposal that will be basic for the analysis proposed in this paper.

The paper is organized as follows: Section 2 provides a brief survey of the uses of noch discussed in the literature. In section 3 König's (1977) proposal is examined. In section 4 an analysis of the comparative use of noch is presented which explains why, in some but not all contexts, it induces norm-relatedness of the comparative form. It will be argued that comparative noch is an instance of the additive use of noch, and

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1 Please note that there are combinations of noch plus comparative which are not subsumed by the notion of comparative noch, cf. (9) and (10) below.
that norm-relatedness is the result of an anaphoric relation of the comparative to an unmodified (i.e. norm-related) positive form. The final section points out open questions for future work.

2 Readings of noch

There are three major readings of the particle noch discussed in the literature, the temporal reading, the marginality reading and the additive reading. In all of these readings the particle presupposes an underlying scale and induces a "dynamic perspective". Noch is closely related to the particle schon ('already') which also presupposes an underlying scale but indicates a different perspective. Since schon is irrelevant for the analysis of comparative noch it will be ignored in this paper.

The temporal reading of noch is demonstrated in (5). The particle indicates that it has been raining before and might stop soon. Temporal noch (but not marginality and additive noch) may be positioned in the beginning of the sentence, and it usually occurs in imperfective sentences (for details see König 1991).

(5) Es regnet noch. / Noch regnet es.
'It is still raining.'

The second reading of noch is the marginality reading. The use of noch in (6) indicates that Osnabrück is a marginal case of being in the Lower Saxony territory. If Osnabrück were located further away from the center of Lower Saxony, it would be beyond the border. Marginality is enhanced by adding gerade ('just').

(6) Osnabrück liegt (gerade) noch in Niedersachsen.
'Osnabrück is still in Lower Saxony.'

The third reading of noch is the additive one. There is a stressed and an unstressed variant which differ in that the unstressed variant requires an additional entity distinct from the associated constituent (i.e. the NP einen Schnaps in (7a,b), whereas the stressed variant requires the additional entity to be an instance of the same kind. In (7a), noch being unstressed, there has to be another drink ordered by Otto distinct from schnaps. In (7b), with stressed noch, the additional drink has to be a schnaps.

(7) a. Otto bestellte noch einen S\textsc{K}NAP\textsc{S} (zusätzlich zu seinem Bier).
'Otto ordered a schnaps (in addition to his beer).'

b. Otto bestellte NOCH einen Schnaps (zusätzlich zu seinen anderen Schnäpsen).
'Otto ordered another schnaps (in addition to his other ones).'

The additive reading of noch is closely related to the additive particle auch ('also') which also appears in a stressed and an unstressed variant. Unstressed auch is similar in meaning (though not identical, cf. section 4.3) to unstressed noch presupposing an additional entity distinct from the associated constituent. For example, (8a) as well as
(7a) presuppose another drink distinct from schnaps. Stressed *auch* is clearly different from stressed *noch*, since it is associated with the subject (or contrastive topic, cf. Krifka 1999). Whereas stressed *noch* in (7b) presupposes another schnaps, stressed *auch* in (8b) presupposes another person ordering schnaps.

(8) a. Otto bestellte auch einen S**CHNAPS** (zusätzlich zu seinem Bier).
   'Otto also ordered a schnaps (in addition to his beer).'

   b. Otto bestellte A**UCH** einen Schnaps (zusätzlich zu anderen Gästen).
   'Otto also ordered a schnaps (in addition to other guests).'

Considering the initial question of how the comparative use of *noch* in (3) and (4) relates to the readings of *noch* discussed in the literature, it is important to note that each of the uses mentioned above – temporal, marginality, additive – may combine with comparative forms. The example in (9) has a temporal reading indicating that Adam might be taller than Berta in the future (which is the only available reading if *noch* is positioned in the beginning of the sentence). In (10) the prominent reading is marginality (enhanced by adding *gerade*): The letter is a marginal case of weighing less than 20g.

(9) Berta ist noch größer als Adam. / Noch ist Berta größer als Adam.
   'Berta is still taller than Adam.'

(10) Der Brief ist (gerade) noch leichter als 20g. (Eine 55 Cent Briefmarke reicht.)
   'The letter still weighs less than 20g. (A 55 Cent stamp will be o.k.)'

As shown in (9) and (10), *noch* combined with a comparative form may have a temporal as well as a marginality reading. But if we try an additive reading we get the comparative use we were looking for. The additive reading of (11) presupposes an additional comparison, or an additional span of height, distinguishing Adam from someone else, which is characteristic for the comparative reading. Although comparative *noch* is usually stressed, stress may also be on the comparative form instead of the particle, for example in the context of an antonym as in (11b). So we find the same pattern as in (7): the stressed variant presupposes the occurrence of the same adjective and unstressed variant presupposes the occurrence of a distinct one.

(11) a. (Adam ist groß/ größer als 1,80m.) Aber Berta ist NOCH größer.
   '(Adam is tall / taller than 1,80m.) But Berta is still taller.'

   b. (Adam ist nicht klein.) Aber Berta ist noch GRÖßER.
   '(It is not the case that Adam is small.) But Berta is still taller.'

\(^{2}\) For ease of presentation, comparative *noch* will be marked by caps (NOCH) in the rest of the paper, which is not meant to exclude unstressed occurrences.
This suggests that the comparative use of *noch* is an instance of the additive reading. But what does it mean to "add another comparison", and why does it (in some contexts) trigger norm-relatedness? We will come back to these question in section 4.

### 3 The meaning of *noch*

The discussion of the meaning of *noch* in the literature has mainly been focused on the question of whether *noch/still* and *schon/already* are duals related by inner and outer negation, cf. Löbner (1989). Since the relation between *noch* and *schon* is irrelevant in this paper – comparative *noch* does not have a *schon* counterpart – we need not go into the problem of duality. It is commonly assumed that temporal and non-temporal uses of *noch/still* differ only with respect to the scale they make use of and presuppose the existence of an additional element ranked lower than the associated constituent. For example, *It is still raining* presupposes a time \( t_i \) immediately preceding the reference time such that it is raining at \( t_i \). The existence of an additional element has often led to the idea that *noch/still* is in general additive. König (1991), for example, argues that *noch* is both additive ('adding up to a larger whole') and scalar ('ranking elements along a scale'). Similarly, Ippolito (2007) claims for the temporal as well as the marginality reading of English *still* that they are additive ('presupposing an additional item') relating to the scale of times and degrees, respectively. While it seems plausible that the readings of *noch/still* differ only with respect to the underlying scale, the nature of the non-temporal scales is rarely discussed. Employing degrees in the case of marginality, as suggested by Ippolito, raises the question of which degrees are employed if the associated constituent is not gradable. Obviously we have to make use of degrees of membership or prototypicality (cf. Kamp & Partee 1995). More vitally, if *noch/still* is always additive, what distinguishes the genuine additive reading?

3 It has been suggested by one of the referees that comparative *noch* is scalar instead of additive, where *scalar* refers to the scale of likeliness. This suggests itself from the point of view of the English translations which often use *even* instead of *still*. But if comparative *noch* were scalar in the sense of likeliness, it should be equivalent to German *sogar* (*even*), which can't be true since it yields different entailments. For example, while *noch* in (i) triggers the entailment that the old web pages have been customer-friendly, substituting *sogar* for *noch* would entail that it is unlikely that the new web pages are more customer-friendly than the old ones, cf. (ii), which is clearly not intended. If you assume that any use of *noch* is scalar in presupposing an order relation, the comparative use of *noch* is, of course, scalar in addition to being additive.

(i) (A company praising their new web pages)

Unsere neuen Webseiten sind noch kundenorientierter.

‘Our new web pages are still more customer-friendly.’

(ii) Unsere neuen Webseiten sind sogar kundenorientierter.

‘Our new web pages are even more customer-friendly.’

4 It is also agreed that *noch* triggers a conversational implicature about, in the case of the temporal interpretation, the future. Krifka (2000) offers a convincing account of how the implicature is induced by the alternative set triggered by *noch*.

5 Ippolito (2007) considers only marginality readings of *still* involving gradable adjectives, like Compact cars are still safe; subcompacts start to get dangerous.
(cf. the schnaps example in (7)) from the other uses, and what is the underlying scale in this case? We will go into these questions at the end of section 4.

3.1 The proposal in König (1977)

König (1977) seems to be the only account in the literature including the comparative use of noch. König distinguishes between temporal and non-temporal uses and proposes the truth conditions presented in (12) and (13) (in a slightly adapted manner). The basic idea is that noch imposes an existential presupposition about an additional element – time point or individual – ranked lower on a scale. In the temporal case, noch combines with a sentence and presupposes a time point preceding the reference time such that the proposition is true at that time. In the non-temporal case noch combines with an individual and a predicate. The presupposition requires that there is an additional individual ranked lower according to an order on individuals, such that the predicate applies to this individual.

(12) temporal
\[
\text{noch } (t_i, \Phi) \quad \text{assertion} \quad \Phi(t_i) \\
\text{presupp.} \quad \exists t_j (j < i) \text{ such that for all } t_k (j \leq k \leq i) \Phi(t_k)
\]

(13) non-temporal
\[
\text{noch } (a, \lambda x. P(x)) \quad \text{assertion} \quad P(a) \\
\text{presupp.} \quad \exists y. y \neq a \land (y < a) \land P(y)
\]

Applying the temporal interpretation is straightforward. Applying the non-temporal interpretation raises the question of how to determine the order of individuals, which is left unspecified in König's proposal. Let us assume that it is provided by the degree of marginality – or inverse prototypicality – of an individual with respect to a given predicate. In (14), for example, the order is taken to be the order of being marginal in Lower Saxony (\(<_{\text{marg_in_LS}}\)).

(14) a. Osnabrück liegt (gerade) noch in Niedersachsen.  
'Osnabrück is still in Lower Saxony.'

b. noch(osna, \lambda x. inLS(x))  
\[
\text{assertion} \quad \text{inLS} \text{ (osna)} \\
\text{presupp.} \quad \exists y. y \neq \text{osna} \land (y <_{\text{marg_in_LS} \text{ osna}}) \land \text{inLS} \text{ (y)}
\]

Before going into König's proposal for the comparative use of noch, we will consider the case of genuine marginality combined with a comparative form, cf. (15). The associated predicate in (15) is being-taller-than-Adam (for short: taller-Adam). How to spell out the marginality order of this predicate? Let us assume that an individual y is less marginal than an individual x in taller-Adam if y exceeds Adam's height by a larger span than x, cf. (15c). This order of marginality yields the intended
interpretation, that is, the presupposition that there is an individual which is taller than Adam and taller than Berta, cf. (15d).

(15) a. Berta ist (gerade) noch größer als Adam.
   'Berta is still taller than Adam.'

   b. noch (berta, \(\lambda x. \text{taller-adam}(x)\))
      assertion taller-adam(berta)
      presup. \(\exists y. y \neq \text{berta} \& (y <_{\text{marg in taller-adam berta}} \& \text{taller-adam}(y))\)

c. \((y <_{\text{marg in taller-adam x}}) \text{iff } (x \text{ taller adam}) \& (y \text{ taller x})\)

d. \(\text{adam} <_{\text{height}} \text{berta} <_{\text{height y}}\)

Following König (1977), the comparative use of noch is a special case of marginality. That is, (16a) is understood as expressing that Adam is such that Berta is marginally taller than Adam. Compared to the genuine marginality case in (15) the roles of the participants are reversed: While in (15) the associated predicate is \text{being-taller-than-Adam}, in (16) it is taken to be \text{being-such-that-Berta-is-taller} (for short: Berta-taller). As before, König does not spell out the marginality order. So what would be a less marginal case of Berta-taller? Obviously, an individual y is less marginal than an individual x in Berta-taller if it falls below Berta's height by a larger span than x, cf. (16c). This yields the correct requirement that the presupposed individual is smaller than Adam and smaller than Berta, cf. (16d).

(16) a. Berta ist NOCH größer als Adam.
   'Berta is still taller than Adam.'

   b. noch (adam, \(\lambda x. \text{berta-taller}(x)\))
      assertion berta-taller (adam)
      presup. \(\exists y. y \neq \text{adam} \& (y <_{\text{marg in berta-taller adam}} \& \text{berta-taller}(y))\)

c. \((y <_{\text{marg in berta-taller x}}) \text{iff } (\text{berta is taller than x}) \& (\text{x is taller than y})\)

d. \(y <_{\text{height adam}} <_{\text{height berta}}\)

Tracing back the comparative use of noch to a particular marginality reading is a truly elegant solution. And, provided that the marginality order is defined as above, it gives the correct results. But as it stands, it does not explain the finding we started out from, that is, the fact that the comparative use of noch may make the comparative form norm-related. König briefly mentions a second comparison. But he does not comment on the problem of norm-relatedness. More importantly, there is no hint on how to derive the proposed interpretation in a compositional way. Why should it be licensed to reverse the roles of the participants and take a sentence like (16a) to be about the comparison base? Is it just a trick giving correct results by mere chance?
3.2 How to license role reversal

The puzzle of how to license the reversal of participants in König's analysis of comparative *noch* is easily solved by assuming the syntactic structures in (17) and (18). While in the genuine marginality case *noch* combines with a DegP including the comparison base, in the comparative reading it combines with an AP. Let us assume that the presupposition triggered by *noch* is composed compositionally and is linked to the outer most argument of the function given by the associated constituent. Then, in the marginality case, the presupposition relates to the predicate *being-taller-than-Adam*, whereas in the comparative case it relates to the predicate *being-such-that-someone-is-taller*, cf. (17c) and (18c). When combined with the remaining arguments we get presuppositions at the sentence level exhibiting the "role reversal" we found in König's original proposal.

(17) a. Berta ist (gerade) noch größer als Adam.
'Berta is still taller than Adam.'

b. [CP Berta [VP ist [DegP noch [DegP [AP größer] [als Adam]]]]]

c. noch (λx. taller-adam(x));
   assertion  λx. taller-adam(x)
   presupp.  λx. ∃z. z≠x & (z <_{marg_in_taller-adam x} x) & taller-adam(z)

(18) a. Berta ist NOCH größer als Adam.
'Berta is still taller than Adam.'

b. [CP Berta [VP ist [DegP [AP noch [AP größer]]] [als Adam]]]

c. noch (λy λx. x taller y);
   assertion  λy λx. x taller y
   presupp.  λy λx. ∃z. z≠y & (z <_{marg_in_x-is-taller y} y) & (x taller z)

According to the analyses above, the reversal of roles in the interpretation is just the outcome of different syntactic structures. Assuming the structure in (18) König's interpretation of comparative *noch* is fully justified. Still, it does not answer the initial question of why the comparative may trigger norm-relatedness when combined with comparative *noch*. And it does not explain why the comparative use patterns with the additive reading of *noch*.

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6 Many thanks to my colleague Stefan Evert for pointing that out to me.
4 The interpretation of comparative noch

It has been argued in section 2 that the comparative use of noch is just the additive reading of noch combined with comparatives, which is intuitively plausible assuming that the addition consists in another comparison and, as a result, in an additional span of height. In König (1977), on the other hand, the comparative use of noch is analyzed as a marginality reading with "reversed roles", which yields the correct predictions but does not account for the norm-relatedness effect.

In this section, it will first be shown that the comparative use of noch is anaphoric. The problem of norm-relatedness will turn out to be a consequence of anaphoricity. An interpretation of comparative noch will be proposed that takes anaphoricity into account. Finally, we will come back to the question of why the comparative reading appears to be an instance of the additive reading.

4.1 Contexts

There are basically three types of contexts of the comparative use of noch: The sentence containing comparative noch may (i) be preceded by a sentence containing the same comparative form, or (ii) be preceded by a sentence containing the positive form or its antonym, or (iii) occur 'out of the blue'. The first type of context is shown in (19a,b). The preceding sentence expresses a comparison between the comparison base of the noch comparative (i.e. the comparative combined with noch) and a third person or a measure phrase. The second type of context is shown in (20a,b). The preceding sentence either ascribes the positive form of the adjective to the comparison base of the noch comparative, or it denies the positive form of the antonym. In the third type of context there is no preceding sentence involving the adjective in question, cf. (21).

(19) a. Adam ist größer als Chris. Aber Berta ist NOCH größer (als Adam).
   'Adam is taller than Chris. But Berta is still taller (than Adam).'

   b. Adam ist größer als 1,80m. Aber Berta ist NOCH größer (als Adam).
   'Adam is taller than 1,80m. But Berta is still taller (than Adam).'

(20) a. Adam ist groß. Aber Berta ist NOCH größer (als Adam).
   'Adam is tall. But Berta is still taller (than Adam)'

   b. Adam ist nicht klein. Aber Berta ist NOCH größer (als Adam).
   'Adam is not small. But Berta is still taller (than Adam).'

(21) Berta ist NOCH größer als Adam.
   'Berta is still taller than Adam.'

7 There are other contexts licensing comparative noch, which are taken to be subsumed by the above classification, e.g. Adam ist so groß wie Chris. ('Adam is as tall as Chris.') and Adam ist ein Riese. ('Adam is a giant.')
Following, e.g., Bierwisch (1989), the unmodified positive form of an adjective relates to a contextually given standard of comparison (what we called 'norm' in the introduction). Thus a statement involving the positive form is traced back to a comparative statement. As a result, the antecedent sentences in (20a,b) express comparative statements – in (a) Adam exceeds the norm of tallness (given by the comparison class), while in (b) he falls short of the norm of smallness. Thus, (19) as well as (20) express statements of the form "Adam is taller than degree $d$, and Berta is taller than Adam".

Now consider norm-relatedness: Neither (19a,b) nor (20b) entail that Berta is taller than the norm. Norm-relatedness is only entailed in the example in (20a), where the antecedent comparison involves the positive form of the same adjective. This suggests that the use of comparative noch triggers norm-relatedness, if and only if the comparison base of the antecedent statement is given by the norm of the adjective in the noch comparative. Norm-relatedness is not entailed if the comparison base of the antecedent is given by a third individual's height or a measure phrase, as in (19a,b), and if the comparison base of the antecedent is given by a different norm, as in (20b) (if someone is not small, he need not be tall).

Coming back to the third type of contexts, as shown in (21): Although there is no overt antecedent, the sentence clearly entails that Adam and Berta are tall. This suggests an analysis analogous to (20a), while accommodating the antecedent. The accommodated antecedent will be composed out of the comparison base of the noch comparative and the norm of the adjective (with respect to the comparison class), that is in (21): Adam is taller than the tallness norm.$^8$

Accordingly, noch comparatives without overt antecedent mostly contain an explicit comparison base, and if they don’t, reconstruction is straightforward. The sentence in (22), for example, is preferably interpreted such that the new web pages are more customer-friendly and informative than the old ones, and it clearly entails that the old ones were customer-friendly and informative.

(22) Unsere neuen Webseiten sind noch kundenorientierter und informativer.

"Our new web pages are still more customer-friendly and informative"

So finally, the finding that noch combined with comparatives entails norm-relatedness in some but not all contexts turns out to be a consequence of the fact that comparative noch is anaphoric requiring an antecedent comparison. The contexts triggering norm-relatedness are those where the antecedent comparison is related to the norm of the adjective of the noch comparative.

$^8$ It is important to note that the accommodated proposition is not an existential one, which would be trivially satisfied, but instead is about the comparison base of the noch comparative. Accommodation of mere existential propositions is a well-known problem for analyses of auch ('also'/'too') leading to the insight that particles do not allow for accommodation (of existential propositions), cf. Zeevat (2003).
4.2 Semantics

The examination of contexts revealed that the comparative use of *noch* is anaphoric relating to a preceding comparison. The subject of the antecedent comparison is identical to the comparison base of the *noch* comparative, and the comparison base of the antecedent comparison may be given by a third individual or a measure phrase or – if the preceding sentence contains an unmodified positive – a contextually determined standard of comparison, i.e. norm value.

Comparing the proposal in König (1977) with these findings there are two major shortcomings. König's presupposition requires the existence of an additional individual satisfying the associated predicate. But what we find is anaphoricity instead of mere existence, and the antecedent is not an individual but a comparison – a pair in a degree relation – such that the first element is equal to the degree of the comparison base of the *noch* comparative.

Since *noch* is known to be a focus particle, a satisfactory interpretation would have to be spelled out in a focus semantic framework (cf. Krifka 2000). Due to limitations of space we will not go into focus semantics in this paper, and instead base the interpretation on the notions of presupposition and anaphor. Following, e.g., Kennedy & McNally (2005), gradable adjectives denote relations between individuals and degrees and come with measure functions mapping their arguments onto the scale associated with the adjective. The adjective *groß* ('tall') thus denotes a relation between an individual \( x \) and a degree of height \( d \) such that the height of \( x \) is at least \( d \), cf. (23a).

For comparative forms, the degree argument picks up the degree of the comparison base, cf. (23c), and for positive forms the degree argument is bound by a contextually determined standard degree of tallness depending on the comparison class, \( d_{\text{s-tall}} \), cf. (23d) (\( d_{\text{s-tall}} \) is regarded as a free variable to be bound by the context).

\[
\begin{align*}
(23) & \quad \text{a. } [[ [A \text{ groß}] ]] = \lambda d \lambda x. \text{ht}(x) \geq d \\
& \quad \text{b. } [[ [A\text{ größer}] ]] = \lambda y \lambda x. \text{ht}(x) > \text{ht}(y) \\
& \quad \text{c. } [[ [\text{DegP größer als Adam}] ]] = \lambda x. \text{ht}(x) > \text{ht(adam)} \\
& \quad \text{d. } [[ [\text{DegP groß}] ]] = \lambda x. \text{ht}(x) \geq d_{\text{s-tall}}
\end{align*}
\]

The interpretation of comparative *noch* is spelled out in (24). Following the presupposition-as-anaphors paradigm (cf. van der Sandt 1992) the comparison anaphor is formulated as a presupposition (underlined). It is of the form \( \text{ht}(y) > d \), where \( y \) will be instantiated by the comparison base of the *noch*-comparative, and \( d \) is a free variable to be bound by the antecedent comparison.\(^9\)

\[
[[ [A\text{ noch }\text{ [A\text{ größer}]]}] ] = \lambda y \lambda x. : \text{ht}(y) > d, \text{ht}(x) > \text{ht}(y)
\]

Applying the interpretation in (24) to the example in (25a) yields the sentence representation in (25b). When updating the sentence (i.e. merging it with the previous

\(^9\) For ease of presentation " > " will be taken to subsume " \( \geq \) " in (24)-(26) as a spezial case.
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discourse, cf. Kamp & Reyle 1993) the presupposed part has to be bound to a suitable antecedent. A suitable antecedent will be one of (26a-d) (cf. the examples in (19) and (20)). Binding the comparison anaphor to one of these antecedents will result in binding the free variable \(d\) to one of the following degrees: \(ht(chris)\), 1,80m, \(d_{S\text{-tall}}\), \(d_{S\text{-small}}\). As a result, it will be entailed that Berta is taller than Chris, or taller than 1,80m, or taller than the tall-standard or the small-standard. Thus only the antecedent in (26c) triggers the entailment that Berta is tall, which is exactly what we want.

(25) a. Berta ist NOCH größer als Adam.
'\textit{Berta is still taller than Adam.}'

b. \(ht(\text{adam}) > d\). \(ht(\text{bertha}) > ht(\text{adam})\)

(26) a. \(ht(\text{adam}) > ht(\text{chris})\)  'Adam is taller than Chris.'

b. \(ht(\text{adam}) > 1,80m\)  'Adam is taller than 1,80m.'

c. \(ht(\text{adam}) > d_{S\text{-tall}}\)  'Adam is tall.'

d. \(ht(\text{adam}) > d_{S\text{-small}}\)  'Adam is not small.'

The analysis of comparative \textit{noch} as requiring an antecedent comparison explains the initial puzzle about its norm-relatedness in some but not all contexts: Norm-relatedness is a consequence of the nature of the antecedent. But although the interpretation of comparative \textit{noch} in (24) yields the correct results, there seems to be something missing when comparing it to the proposal in König (1977): Where is the order – of time or marginality – which is commonly regarded as essential for the meaning of \textit{noch}?

4.3 Additivity of comparative \textit{noch}

In contrast to the additive particle \textit{auch} (\textit{also}) additive \textit{noch} has mainly been ignored in the literature (apart from Nederstigt 2003, who focuses on language acquisition). It will be argued in Umbach (in prep.) that additive \textit{noch} – like \textit{auch} – is always anaphoric. Thus the additional item has to be previously mentioned. The difference between the stressed and the unstressed variant (cf. the example in (7)) is accounted for by deaccenting requirements in the case of type-identical antecedents. The difference between additive \textit{auch} and additive \textit{noch} is attributed to the fact that additive \textit{noch} – unlike \textit{auch} – relates to a scale, as do the temporal and the marginality readings of \textit{noch}. While temporal \textit{noch} relates to the order of time and marginality \textit{noch} relates to the order of (inverse) prototypicality, additive \textit{noch} simply relates to the order of mentioning. The order of mentioning is, however, frequently aligned with a contextually given 'semantic' scale, for example, time in narratives.

Comparative \textit{noch} requires an antecedent. This is what makes it additive. The related scale is, first of all, to the order of mentioning. But the order of mentioning is aligned to the order of degrees given by the adjective of the \textit{noch}-comparative such that the latter preserves the former: If comparison1 one precedes comparison2 in mentioning,
the comparison subject of comparison1 has to precede the comparison subject and the comparison base of comparison2 with respect to the order of degrees. For example, the sequence in (27a) yields the order of mentioning of the comparison statements in (27b) which is preserved by the order of height, cf. (27c). This finally explains why for comparative noch the antecedent has to be such that its comparison subject is identical to comparison base of the noch-comparative. If it were the other way around, as shown in (27d), structure preserving alignment would not be possible.

(27) a. Adam ist größer als Chris. Berta ist NOCH größer als Adam.
   'Adam is taller than Chris. Berta is still taller.'

   b. (Adam >_{height} Chris) <_{mention} (Berta >_{height} Adam)

   c. Chris <_{height} Adam <_{height} Berta

   d. # Chris ist größer als Adam. Berta ist NOCH größer als Adam.
      'Chris is taller than Adam. Berta is still taller.'

Unlike additive noch, the additive particle auch does not relate to an underlying order. The order of mentioning, though trivially given, is not aligned with the order of the degree scale when auch is associated with a gradable adjective. So we find the sequence in (28a) where Berta may be taller than Adam or vice versa. And we even find sequences employing different adjectives relating to different scales of degree, cf. (28b).

      'Adam is taller than Chris. Berta is also taller.'

   b. Berta ist stärker als Adam. Sie ist auch größer.
      'Berta is stronger than Adam. She is also taller.'

To conclude, the particle noch is commonly agreed to be scalar. At the same time it is said to be additive because it presupposes the existence of an element ranked lower than the one associated with noch. This conception of additivity, however, fails to characterize the genuinely additive reading of noch (which is, in fact, excluded in König 1977). Viewing additive noch as anaphoric relating to the order of mention supports the idea that all uses of noch are scalar, while distinguishing the additive reading from the temporal and the marginality reading. Moreover, the comparative use of noch is subsumed as a particular instance of the additive reading relating primarily to the order of mention and secondarily to the order of degrees given by the adjective.

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10 Ippolito (2007), while maintaining the idea that English still is always additive, does not come across the problem of genuine additivity because English still does not have that reading.
5 Conclusion

The problem we started out from in this paper was the problem of norm-relatedness: In some but not all contexts the comparative use of noch triggers norm-relatedness, which is at odds with the fact that comparatives in general are not norm-related. A closer examination revealed that comparative noch is anaphoric relating to an antecedent comparison. An interpretation of comparative noch has been proposed which accounts for anaphorocity. The puzzle of norm-relatedness is explained by the nature of antecedents: Norm-relatedness is entailed if and only if the antecedent comparison is norm-related.

There are many open questions. Although the particle noch is undoubtedly focus-sensitive, the semantics of noch suggested in this paper has not been spelled out in a focus-semantic framework. The main obstacle is the fact that comparative noch, like additive noch in general, may carry an accent. It is unclear, however, how to interpret this accent: Is it a focus? If so, what are the alternatives? Unfortunately, an interpretation along the lines of Krifka's (1999) account of stressed auch is not viable because the associated constituent is the same for the unstressed and the stressed version of additive noch. The problem will be taken up in Umbach (in prep.).

Taking focus-sensitivity into account, it suggests itself to rephrase the present interpretation of comparative noch analogous to Krifka's (2000) proposal for temporal noch, where alternatives are ordered. The ordering yields a surprisingly simple explanation for the implicatures triggered by temporal as well as marginality noch (for example, It is still raining implicates that it might stop soon). But there are no such implicatures in the case of comparative noch. Why is that?

Another open issue is the relation of comparative noch to the scalar particle sogar ('even'). It has been argued that comparative noch does not relate to the scale of likeliness, since it cannot be substituted by sogar (cf. footnote 4). On the other hand, comparative noch is frequently translated into English by even indicating that the scale of likeliness must be close in some sense to the scale of degrees.

The meaning of noch is just one side of noch comparatives, the other one being gradability. Although the norm-relatedness of the noch comparative turned out to be harmless from the point of view of the semantics of gradability, it gives rise to subsequent questions. How to explain, for example, that with evaluative adjectives noch comparatives seem preferred to unmodified comparatives, the latter triggering a negative implicature? In (29) the (a)-example, but not the (b)-example, entails norm-relatedness, which has been discussed in this paper. But in addition, the latter but not the former gives rise to the implicature that the paintings are not impressive. What does that predict for the structure of evaluative adjectives?

(29) (about an art exhibition)

a. Die Foto sind NOCH beeindruckender als die Bilder.
   'The photos are still more impressive than the paintings.'

b. Die Foto sind beeindruckender als die Bilder.
   'The photos are more impressive than the paintings.'
In general, it would be interesting to investigate absolute adjectives like *voll* ('full') in *noch* comparatives, since they make use of the maximum of the scale instead of a contextually given threshold (cf. Kennedy & McNally 2005). What does it mean to be *NOCH voller* if *voll* is maximum standard?

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**References**


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