

Abstracts for the workshop on

Implicature and conversational meaning

16-20 August 2004, Nancy

organised as part of the
European Summer School on
Logic, Language and Information

by

Bart Geurts & Rob van der Sandt
University of Nijmegen

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A mental-model-theoretic account of *Free Choice Permission*

Fabian Battaglini

University of Louvain-la-Neuve (Belgium)

battaglini@lofs.ucl.ac.be

0. Introduction

In this paper, I will put forward a mental-model-theoretic alternative to Zimmermann's (2000) and Geurts' (2003) account of Free Choice Permission. Crucial to my account will be the fact that reasoners tend to diminish the load on working memory.

1. Free Choice Permission

Kamp (1973, 1978) notes that, while deontic logic does not allow the inference from (1) to (2), sentences of the form of (1) are construed as implying (2)¹. Following von Wright (see Kamp 1973: 62), let's call this phenomenon *the paradox of Free Choice Permission* (*Free Choice Permission*, henceforth).

- (1) X may A or B
- (2) X may A and X may B

2. The modal account

Zimmermann (2000) and Geurts (2003) provide a semantic account of this phenomenon; I will call this account the disjunctions as covert modals view (or, in short, the modal view). On this view, the traditional truth-conditional analysis of the meaning of *or* is wrong and disjunctions have to be analysed as conjunctions of modal propositions. That is, within this framework, a disjunctive assertion *p or q* means that *it is possible that p and it is possible that q*.

This move allows accounting for Free Choice Permission. Here is an outline of this account as developed by Bart Geurts: (1) has to be analysed as (3); in (3), within each conjunct, the modals fuse; this results in (4).

- (3) It may be that X may A and it may be that X may B
- (4) X may A and X may B

¹ In these formulas, "X" denotes individuals; "A" and "B" denote actions.

3. Empirical problem of the modal account

The modal view does not make the right predictions with respect to psychological data. The data I will use come from Noveck et al. (2002). These authors show, among other things, that a statistically significant (and even substantial) proportion of their subjects consider that the syllogisms in (5) and (6) are valid:

- (5) If P or Q then R ; P //Therefore, R
 (6) P or Q ; not Q //Therefore, P

If the disjunctions of the first premises of each syllogism were interpreted as modals, the resulting syllogisms would have been judged invalid by the same subjects (note that other data show that subjects master the semantics of conjunctive sentences): in (5) the invalidity would come from the fact that the second premise, P , does not entail the antecedent of the conditional, i.e., according to the modal analysis, *it is possible that P and it is possible that Q* . In (6) it would come from the fact that there is no means for *not Q* together with the first premise interpreted as a conjunction of modals to entail that P is the case. But subjects judge that these syllogisms are valid, while they would have been able to detect the aforementioned causes of invalidity. Therefore, the disjunctions as covert modals view being unable to make the right predictions with respect to these attested data, we have to conclude that it does not account for the meaning of natural language disjunctions.

4. The mental-model-theoretic account

In this paper, I would like to put forward an alternative approach to the modal view, which can account for Free Choice Permission *and* maintains the traditional truth-conditional view on the meaning of *or*.

4.1. Two (experimentally corroborated) assumptions of the Mental Models Theory

Assumption 1: The principle of truth

A fundamental assumption of the mental models theory of reasoning is that, in order to minimise the load on working memory, reasoners construct models of the premises in which they represent explicitly only what is true, and not what is false. This principle applies at two levels: individuals represent only true possibilities; and they represent only the true components of these true possibilities. This point can be clarified by comparing the truth tables for inclusive and exclusive disjunctions with the representations of the mental models for the same sentences (I represent the true possibilities in bold; and the true components of these true possibilities in italics):

(7) Truth tables for an inclusive disjunction and for an exclusive disjunction

First disjunct: p	Second disjunct: q	p or q, or both	p or q, not both
True	True	True	False
True	False	True	True
False	True	True	True
False	False	False	False

(8) Representations of the mental models for an inclusive disjunction and for an exclusive disjunction

p or q, or both

p
 q
 p q

p or q, not both

p
 q

Assumption 2:

According to Bell & Johnson-Laird (1998), a conclusion is possible if it holds in at least one model (and a conclusion is necessary if it holds in all the models.)

Consequence of these two assumptions

Therefore, given these two assumptions, the mental models of *p or q* (be this disjunction inclusive or exclusive) lead to the conclusions that *p is possible* and *q is possible*. By and-introduction, these conclusions lead to the further conclusion that *p is possible and q is possible*. Here is a sketch of the interpretive process of a disjunctive premise according to Mental Models Theory:

- (i) p or q
- (ii) Therefore, p is possible
- (iii) Therefore, q is possible

- (iv) Therefore (by and-introduction), p is possible and q is possible

4.2. Application to Free Choice Permission

It is the same reasoning where p denotes *may p* and q denotes *may q*:

- (i) May p or may q ²
- (ii) Therefore, may p is possible
- (iii) Therefore, may q is possible
- (iv) Therefore (by and-introduction), may p is possible and may q is possible

A further step is required that will consist in fusing the modals so as to arrive at *may p and may q*. Here is a tentative account of how this step could be justified: Firstly, I will assume that *may p* can be equated with *p is possible*. Thus, *may p is possible and may q is possible* can be paraphrased as *it is possible that p is possible and it is possible that q is possible*. Secondly, concerning the fusion of the modals strictly speaking, I will reason as follows: The fusion of the two *possible* in each conjunct can be seen as an inferential process, with “possible possible p ” as the premise, and “possible p ” as the conclusion. Since (in a Leibnizian modal semantics at least) the premise does entail the conclusion, and the conclusion does entail the premise, the two expressions convey the same amount of information and are thus interchangeable. Furthermore, the premise is more complex than the conclusion and will take more place within working memory. Therefore, we can assume that reasoners, in order to diminish the load on working memory, will only maintain in memory the simplest expression, i.e. the conclusion “possible p ”.

5. Prospective research

Another fundamental assumption of the model theory is that the difficulty of a reasoning problem should vary according to the number of mental models needed for its solution. This is because of the demands placed on working memory. As already noted (see Johnson-Laird & Byrne 1991), this assumption could account for the interpretation of disjunctions.

Noveck et al. (2002) assume that disjunctive statements are initially interpreted as inclusive before either (a) remaining so, or (b) becoming exclusive by way of an implicature (*but not both*). They also note that the exclusive reading is the default one in upward entailing contexts because in such situations the exclusive interpretation is more informative than the inclusive one; but in downward entailing contexts, where the exclusive reading is the less informative reading, the preferred interpretation is the inclusive one. So, within their framework, a disjunction’s ultimate

² *May p or may q* is equivalent to *May p or q*.

interpretation is based on its potential informativeness. Finally, they add that the function of informativeness could be motivated either by Radical Pragmatics' principles or by relevance-theoretic ones.

Mental models theory can explain the same set of data but it is theoretically stronger since it explains the interpretation of disjunctive statements in invoking highly uncontroversial grounds: the need to spare the limited storage capacities of working memory. Here is how the justification proceeds: In upward entailing contexts, the number of mental models for exclusive disjunctions is lower than the one for inclusive disjunctions; in order to minimise the load on working memory, the exclusive reading will be selected. In downward entailing contexts, the situation is reversed since *Not p or q, or both* has one model, while *Not p or q, and both* has two models; in order to minimise the load on working memory, the inclusive reading will be selected.

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Implicature Computation and Attitude Predicates (Yurie Hara (University of Delaware))

Chierchia (2001) has proposed that implicatures are generated locally and projected compositionally. Implicatures induced by Japanese Contrastive Topic provide evidence for the local computation of implicature; however, their properties are not fully compatible with Chierchia's analysis. This paper shows that implicature computation should take place in a larger cycle than Chierchia's, namely at the position where a proposition is combined with an attitude predicate. The analysis mirrors Heim's (1992) theory on presupposition projection.

Japanese Contrastive Topics always induce implicatures. In other words, Contrastive Topic *wa* (as in (1)) is licensed under the situation where something else is implicated. The same implicature will arise when the sentence is not *wa*-marked (*Nanninka-ga kita*. 'Some people-Nom came' will also implicates "Not everyone came." as a conversational scalar implicature). The difference between *wa*-marked and non-*wa*-marked is clearer in (2). The *wa*-induced implicature is conventional and hence obligatory (as in (2a)), whereas the non-*wa*-marked one is conversational and defeasible (as in (2b); see Hara (To appear) for the detailed discussion). Hara (2004) proposes that *wa* seeks for a stronger scalar alternative. This property is depicted as a presuppositional requirement ((3b); x is an attitude-bearer, B is a background and T is a topical element; see Hara (2004) for the comparison of this analysis with Büring (1997)). For example, (1) implicates the speaker's uncertainty of the stronger (more informative) alternative, 'Everyone came'. (2a) is infelicitous since the asserted proposition 'Everyone came' is the strongest among the alternatives ('Some people came', 'Most people came' etc.), and thus there is no room to implicate.

- (1) Nanninka-**wa** kita.
some-people-C_{Top} came.
'[Some people]_{C_{Top}} came.' (Implicature: I don't assert everyone came)
- (2) a. # Minna-**wa** kita.
Everyone-C_{Top} came (no implicature is possible)
b. Minna-**ga** kita.
'Everyone came'
- (3) CONTRASTIVE(w)(x)(B)(T)
a. asserts: $B(T)(w)$
b. presupposes: $\forall w' \in \min_w [w' \in \text{Dox}_x(w)] : \exists T' [T' \in \text{ALT}_C(T) \ \& \ B(T')(w') \text{ entails } B(T)(w') \ \& \ B(T)(w') \text{ doesn't entail } B(T')(w')]$
c. implicates: $\exists w' \in \min_w [w' \in \text{Dox}_x(w)] : \forall T' [T' \in \text{ALT}_C(T) \ \& \ B(T')(w') \text{ entails } B(T)(w') \ \& \ B(T)(w') \text{ doesn't entail } B(T')(w')] [B(T')(w')=0]$

The main question of this paper is when this licensing takes place if *wa* is in an embedded clause, in other words, when are implicatures computed? In Chierchia (2001), scalar implicature computation takes place very locally. In a downward-entailing context, therefore, locally introduced scalar implicatures are removed; otherwise, they would violate the Strength Condition, which prohibits the strong meaning (plain meaning plus implicature) from being weaker than (i.e. entailed by) the plain meaning. In the subsequent computation, a new implicature is added.

With *wa*-induced implicatures, the ungrammaticality of (4) can be accounted for along the same line with Chierchia. If we kept the locally computed implicature "John doesn't read 4 books," the conditional antecedent has more content; thus, as a whole, the strong meaning would become weaker, violating the Strength Condition. Therefore, the local implicature must be removed according to Chierchia. Since *wa* requires implicatures, however, the sentence (4) crashes. In (5), on the other hand, the whole sentence keeps the locally computed implicature, "The professor doesn't believe John reads 4 books". This should also yield a weakening of information at the matrix derivation, which is not allowed in Chierchia's theory.

- (4) * John-ga hon-o 3-satsu-**wa** yom-eba, gougaku-suru.
'If John reads [3]_{C_{Top}} books, he will pass.'

- (5) John-ga hon-o 3-satsu-**wa** yonda-to kyouju-ga shinjite ir-eba, goukaku-suru.
 John-Nom book-Acc 3-Class-Top read-Comp prof-Nom believe be-Comp, pass-do
 ‘If the professor believes John read [3]_{C_{Top}} books, he will pass.’

Therefore, instead of checking the Strength Condition at each step of derivation, I propose that the implicature of *wa* is introduced when the proposition is applied to the attitude predicate. Once the Strength Condition is checked within the set of doxastically accessible worlds for the local attitude-bearer, it does not need to be checked at a higher derivation. The current proposal is inspired by Heim (1992), who formalizes Karttunen’s (1973, 1974) observations on presupposition projection in a framework of Context Change Semantics. In Heim (and Karttunen), if ϕ presupposes p , then α *believes* ϕ presupposes that α *believes* p . It does not presuppose p itself. Likewise, the implicature computation depends on where the presupposition is projected, and thus the whole sentence does not need to satisfy the Strength Condition (or presuppositional requirement). In (5), “John read [3]_{C_{Top}} books” is defined iff in all worlds w' differing minimally from w and doxastically accessible to the professor, there exists an alternative proposition in w' such that it entails the assertion *John read 3 books* but the assertion does not entail it, namely, *John read 4 books*. (See Tredinnick (2004) for a similar analysis for English -ever free relatives.) Followingly, by (3c) we obtain the local implicature attributed to the professor, “there exists some worlds doxastically accessible to the professor where it is not the case that John read 4 books” $\approx$ “The professor is not sure whether John read 4 books”.

In this analysis, we do not have to worry about removing the local implicature in a Downward Entailing context if there is no attitude predicate, since the local implicature is never introduced. Take an English example, “If John reads 3 books, he passes”. Having no attitude predicate, the only attitude bearer is the speaker, and the location of the implicature computation is at the matrix. The stronger scalar alternative to this sentence is “If John reads 2 books, he passes”; thus the sentence implicates, “It is not the case that if John reads 2 books, he passes”.

As a lexical property of *wa*, I further implement this semantic(/pragmatic) account in the syntax by postulating an implicature operator that moves to an attitude predicate. To illustrate, (6) is ambiguous depending on which attitude-bearer (the speaker or Mary) is responsible for the implicatures; i.e. holds the uncertainty of the stronger alternative (Local: The speaker asserts [Mary believes some people came and she doesn’t believe everyone came]; Global: The speaker asserts [Mary believes some people came] and the speaker doesn’t assert [Mary believes everyone came]). At the base position, *wa* generates scalar alternatives (e.g. {one, some, most, every}) and the implicature operator, which moves to the attitude-bearer position, computes the implicature by picking an alternative stronger than the plain meaning. (Note: I do not assume this operator movement in the computation of conversational scalar implicatures like in English.)

- (6) nanninka-wa kita-to Mary-ga shinjite-iru
 some-people-C_{Top} come-Comp Mary-nom believe-Prog
 Mary believes [some]_{C_{Top}} people came

- (7)
$$\left[\text{Op}_{\text{CP}} \overset{\text{local}}{\underset{\text{global}}{\text{Op}_{\text{CP}} \left[\text{XP} \right] t_{\text{XP}} \text{some-people}}} \right] \text{ALT-}wa \text{ came Comp }] \text{ Mary believe }]$$

(Note: Only the operator moves and ‘some people’ remains *in situ*)

This analysis accounts for the contrast between (5) and (4). In (5), the operator finds the attitude-bearer within the adjunct clause; therefore *wa* is licensed as an indication of the professor’s uncertainty about alternatives (“the professor is not sure that John reads 4”). In (4), there is no attitude-bearer within the *if*-clause, therefore the operator has to target the global implicature (the speaker’s uncertainty). However, this movement is blocked as an island violation; hence (4) is unacceptable.

Cancelation Resistant PCIs

Janneke Huitink

Dept. of Philosophy
University of Nijmegen
j.huitink@phil.kun.nl

Jennifer Spenader

Center for Language and Cognition
University of Groningen
j.k.spenader@let.rug.nl

1. Introduction

An implicature i that arises from an utterance U is cancelable if U is consistent with *not* i . If i is a cancelable implicature, then it is a conversational implicature. However, some particularized conversational implicatures (PCIs) cannot straightforwardly be canceled. Imagine that Mr. X is applying for a philosophy position and his teacher is writing him the following letter of recommendation:

- (1) Mr. X's command of English is excellent and his attendance at tutorials has been regular. He is a brilliant philosopher.

The first sentence of (1) carries the PCI that Mr. X isn't a brilliant philosopher, which we call i . The second sentence is a cancelation phrase, i.e. its literal content is *not* i . Generally, this phrase should be able to cancel the implicature. But the discourse in (1) allows for two different interpretations. Under the first interpretation the implicature of the first sentence is indeed canceled. But under the second interpretation, the cancelation phrase itself is interpreted non-literally. The speaker is understood as exploiting the maxim of Quality, i.e. the second sentence is read ironically. As such, the second sentence confirms the implicature of the first sentence. We will call PCIs like the PCI of the first sentence of (1) *cancelation resistant PCIs*.

In this paper we argue that these cancelation resistant PCIs have become semi-conventionalized. That is, in specific contexts, the implicature is so strongly attached to what is literally said, that canceling the implicature becomes very difficult. Hearers often refuse to accept an explicit cancelation, instead preferring to interpret the speaker as being ironic.

2. Background

2.1. Source of PCIs

Conversational implicatures arise under the assumption that speakers adhere to the Cooperative Prin-

ciple (CP): "make your conversational contribution such as is required, at the stage at which it occurs, by the accepted purpose or direction of the talk exchange in which you are engaged" (Grice, 1975, 45). Particularized conversational implicatures are *context dependent* inferences based on the assumption that speakers are being cooperative, following Gricean maxims. The same utterance may give rise to different PCIs in different contexts. This sets PCIs apart from generalized conversational implicatures (GCIs).¹ Consider the following examples from (Levinson, 2000, 16-17) that illustrate the difference:

- (2) A: What time is it?
B: Some of the guests are already leaving.
PCI: It must be late.
- (3) A: Where is John?
B: Some of the guests are already leaving.
PCI: Perhaps John has already left.

B's utterance carries different PCIs in (2) and (3), yet the same GCI arises: not all the guests are already leaving.

(Grice, 1975) identified three ways in which implicatures can be derived.² Implicatures can arise by speakers exploiting or flouting a maxim, by a clash between maxims, where a speaker breaks one maxim in order to avoid violating another maxim, or, in some cases implicatures may arise without breaking any maxims at all.

¹Note that some researchers ((Carston, 2004), (Hirschberg, 1985)) make no distinction between PCIs and GCIs, considering it to be more a difference of degree than type, but see (Levinson, 2000) for a defense of the distinction.

²For alternative ways of deriving implicatures, see for instance (Green and Carberry, 1992) for an account based on discourse relations, or (van Rooy, 2003) for an analysis based on exhaustification of answers. Since we know of no alternative means to derive the implicatures of all the examples we discuss, we take Grice's theory as our point of departure, even though Grice is not explicit on many points.

- (4) A: I am out of petrol.
B: There is a garage around the corner.
- (5) Miss X produced a series of sounds that corresponded closely with the score of “Home Sweet Home”.

According to Grice, the implicature in (4) is that the garage is open, and this is derived under the assumption that the speaker is obeying the maxim of Relation: be relevant. B would be infringing that maxim with his statement if he didn’t think that the garage is open. In contrast, the implicature of example (5) arises because the speaker blatantly fails to observe the maxim of Manner: be brief and succinct. Violating a maxim does not always mean that the speaker is opting out of the Cooperative Principle. Unless the speaker has indicated that he is unwilling to be cooperative, the hearer must try to reconcile the violation with the assumption that the speaker adheres to the CP. The speaker’s failure to be brief can be explained under the supposition that he thinks that Miss X is not a great singer. This then is what the speaker is implicating.

Some researchers doubt that implicatures can arise without breaking any maxims. For instance, Bach and Harnish criticize Grice’s analysis of example (4). They argue that if the speaker implicates that which he must be assumed to believe in order to preserve the assumption that he is observing the maxim of relation, then the speaker has infringed the maxim of relation at the level of what is said (Bach and Harnish, 1979, 170: fn. 37). That means that the implicatures in both (4) and (5) are derived from the speaker’s violation of one of the maxims.

Regardless of whether the difference between (4) and (5) is viewed as a matter of degree or as a matter of kind, there is still an intuitive difference in the ease with which the implicature can be integrated in the discourse. In (4), B’s answer is obviously related to A’s question. But for (5), it is not immediately evident why the speaker would utter such a complex predicate. In (5), the speaker *blatantly* violates the maxim of Manner. It is hard to provide a clear cut definition of *blatancy*. We assume *blatancy* as an intuitive notion.

Finally, Grice also identified a third group of implicatures that arise from a clash between the maxims. These implicatures usually arise when the speaker cannot be more informative and still be truthful. In (6) for instance the implicature is that the speaker doesn’t know where in the South of France C lives:

- (6) A: Where does C live?
B: Somewhere in the South of France.

2.2. Canceling implicatures

Cancelability is one of the tests proposed by Grice in order to distinguish conversational implicatures from conventional implicatures. Of all the necessary conditions that Grice lists for conversational implicature, cancelability is considered to be the most useful one, because cancelability also distinguishes implicatures from entailments and some presuppositions (Hirschberg, 1985, 27).

Implicatures are defined as those inferences derivable by the CP from what is said that the speaker *intends* to communicate. As Hirschberg points out, this makes it difficult to ever actually interpret a cancellation phrase as canceling an implicature, since if the speaker uses that cancellation phrase, he must never have intended to communicate that implicature in the first place (Hirschberg, 1985, 27). This means that the first half of speaker B’s utterance in (7) cannot be analyzed as implicating that Sally won’t attend the meeting, because the second half contradicts this, i.e. “cancellation” is a misnomer because the presence of the “cancellation phrase” makes it clear that there was no implicature intended in the first place.

- (7) A: Will Sally attend the meeting?
B: Her car broke down but she’ll still be there.

Hirschberg suggests that examples as these can be naturally understood as the speaker trying to block unwanted inferences that he expects the hearer may draw. Suppose one wants to find out whether p_j is conversationally implicated by an utterance p_i . Then, according to Hirschberg, it is sufficient to ask “whether the assertion of $p_i \wedge \neg p_j$ would be felicitous – without specifying that such an artificial construction itself represents an implicature and its cancellation” (Hirschberg, 1985, 28).

Cancelability as a test plays out differently depending on the type of information that is canceled. In general, the degree of conventionality influences the felicity of the cancellation. A high degree of conventionality corresponds to a high degree of infelicity. For example, trying to cancel an entailment (8) or an unembedded presupposition (9) generally results in nonsensical discourse.³

³Note however that in dialogue, another speaker is free to cancel these types of information, and this is then analyzed as a case of *denial*.

- (8) ?? Bill and Harry left, but Harry didn't leave.
 (9) ?? It's odd that dogs eat cheese, even though they don't.

In cases where a conventional implicature is cancelled, the discourse becomes odd, but less odd than in (8) and (9).

- (10) ? He is an Englishman; he is, therefore, brave, but I don't mean to imply that there is a connection between the two.

In contrast, conversational implicatures are easy to cancel. The following piece of discourse, in which a PCI is canceled, is perfectly felicitous:

- (11) A: Smith doesn't seem to have a girlfriend these days.
 B: He has been paying a lot of visits to New York lately, but I don't think he has a girlfriend there.

As said in the introduction, some PCIs are resistant to cancellation. For instance, in (12), it is not clear whether the speaker wants to block the inference that Miss X is a terrible singer or is confirming the inference that she is not, i.e. that the speaker was ironic when saying *She has a beautiful voice*:

- (12) Miss X produced a series of sounds that corresponded closely with the score of "Home Sweet Home". She has a beautiful voice.

What does the speaker intend to convey? The source of the confusion is the fact that based on the Cooperative Principle (CP), *every* utterance can potentially convey more than what is literally said. Thus cancellation phrases may also be understood as carrying an implicature themselves. The cancellation phrase in (5) is ambiguous between two readings. Either what is literally said is all that is conveyed, i.e. it is a straightforward cancellation of the previous implicature, or the cancellation phrase itself gives rise to an implicature, arising from exploiting the first maxim of Quality: don't say what you believe to be false. The speaker means to convey the *opposite* of what is literally said, i.e. the speaker's being ironic. The implicature of the cancellation phrase confirms the implicature of the first sentence.⁴

⁴Of course there are other possible interpretations as well, e.g. the speaker may have forgotten the English word for singing, or the speaker is playing some sort of game in

There is a surprising difference between the examples in (7) and (11) on the one hand and (1) and (12) on the other. For (7) and (11) only the non-ironic interpretation for the cancellation phrase seems prominent. In (7), the speaker intends to convey that despite the car trouble, Sally will be at the meeting. But for (1) and (12) it is easy to get the ironic interpretation.

We propose the following explanation. The ironic interpretation is obtained under the assumption that the speaker is infringing Quality. The maxim of Quality is often thought to have a privileged status, since it is hard to see how the other maxims can be fulfilled if Quality isn't satisfied (Levinson, 1983). Therefore, one has to have good reasons to suppose that the speaker is exploiting it. Apparently, in example (1) there is better reason to assume that the speaker is ironic than in (7). The likeliness of the ironic interpretation is influenced by at least two factors, which we examine in this paper. These are the origin of the implicature and the type of topic in which the implicature frequently arises, which influences the degree of conventionality of the implicature.

3. Data

Let's look at a very telling example of a PCI that is difficult to cancel. The following example is taken from (Horn, 2004, 5). The conversation comes from the movie *When Harry met Sally* (1989). Harry is setting up a blind date between Sally and his friend Jess:

- (13) Jess: If she's so great why aren't YOU taking her out?
 Harry: I told you, we're just friends.
 Jess: So you're saying she's not that attractive.
 Harry: No, I told you, she IS attractive.
 Jess: But you also said she has a good personality.
 Harry: .She HAS a good personality.
 Jess: *When someone's not that attractive they're ALWAYS described as having a good personality.*
 Harry: Look if you were to ask me *what does she look like* ? and I said she has a good personality, that means she's not attractive. But just because I happen to mention that she has a good personality, she could be either.

which it is forbidden to use words that rhyme with 'bang'. But these interpretations are very unlikely.

Horn uses (13) to illustrate the difference between PCIs and GCIs. According to Horn, Jess's italicized utterance, "reanalyzes a particularized implicature (S, in describing X to H as having a good personality implicates that X is not attractive) as generalized, to which Harry responds by patiently pointing out the strongly context dependent nature of the inference in question" (Horn, 2004, 5).

We have a different interpretation. If Jess is really interpreting a PCI as a GCI, then he should have said that when you describe someone as having a good personality, you always mean that they are not attractive. However Jess is saying the opposite, and we think this should be taken more seriously. Jess is actually expressing the fact that the expression "has a good personality" has been conventionalized as an expression to describe someone who isn't attractive without doing so directly.

Consider Harry's response that the expression that Sally has a good personality only means that she's not attractive in a context where the question is what Sally looks like. Note that Harry seems to agree with Jess's evaluation that in such a context, saying someone has a good personality always is intended to convey that they are not attractive. In the following example we manipulated the context, and the cancelation is indeed odd.

- (14) J: What does Sally look like?
 H: ? She has a good personality, but I don't mean to imply that she isn't attractive.

Jess could now still reply that when someone's not that attractive they're *always* described as having a good personality. That is, discourse (15) is natural, in contrast to (16):

- (15) J: What does Sally look like?
 H: She has a good personality. And she is also attractive.
 J: But you also said that she has a good personality.
 H: She HAS a good personality.
 J: When someone's not that attractive they're ALWAYS described as having a good personality.
- (16) J: Will Sally attend the meeting?
 H: Her car broke down, but she will still be there.
 J: But you also said her car broke down.
 H: Her car DID break down.
 J: When someone will not attend a meeting, this is ALWAYS described as their car having broken down.

It is strange in (16) for Jess to object and confront Harry with the fact that he also said that Sally's car broke down. It doesn't seem as if Jess is a competent speaker of English. But in (15) it seems far less strange to ask Harry why he chose to say that Sally has a good personality. In (15) Jess is still suspicious about Sally's looks.

Thus, some PCIs are cancelation resistant to the degree that conversation participants are willing to argue about the right of the other speaker to cancel the implicature. The data presented in this section also show that the reluctance to be canceled is dependent on the context of utterance.

4. Analysis

There may be many factors that contribute to raising the prominence of the ironic reading. We think we've identified two main features that the set of examples we have examined share. The first is the common source of the implicature of the original utterance. And the second is the degree to which the expression that gives rise to the implicature has been conventionalized in certain contexts.

4.1. Maxim exploitation

One key feature that all the examples of cancelation resistant PCIs share, is that their source of origin is the flouting or exploitation of one of the maxims. If a maxim has been flouted by an utterance, thus giving rise to an implicature, then canceling that implicature makes the initial utterance (what is said) seem odd. Suppose that (1) was intended as a positive letter of recommendation. Then we must conclude that the writer has at least written the letter in a funny order. In a way, this also counts as not very cooperative behavior. The writer of (1) has violated the maxim of Manner. Similarly, in (12) if Miss X has such a beautiful voice, then why would A say that she produced a series of sounds that corresponded closely to the score of "Home Sweet Home"?

In cases like these, interpreting the cancelation phrase as ironic becomes a good option. Only under this interpretation can the speaker's entire utterance be understood as not violating any of the maxims.

In contrast, in (11), which doesn't arise from flouting a maxim, there is still a way to make sense of the speaker's entire utterance without supposing that a maxim is violated. Even if Smith's visits to New York do not mean that he has a girlfriend there, at least the speaker is granting that one might take these visits as evidence for the existence of a girlfriend in New York. Mentioning these visits is not irrelevant.

4.2. Context Dependence and Cancelability

Recall that cancelability is a test to distinguish conventional implicatures from conversational implicatures. Given that the additional meanings in the examples are implicatures, and that in some contexts these implicatures are reluctant to be canceled, we may conclude that these PCIs have become semi-conventionalized.

That conversational implicatures could develop into conventional meanings is not a strange idea at all, and has been argued for in various places in the literature. For example, (Cole, 1975) argues for the case that *let's* has developed a conventionalized meaning as a second person imperative. Consider the following example from (Cole, 1975, 261):

- (17) Listen, Sam. Let's get that work out, before we lose the client, why don't you?

The literal meaning of *let's* is first person plural. But the reading of (17) is that the speaker is not intending to help Sam with his work. Note that the sentence accepts a second person tag-question, which indicates that the second person imperative meaning has become so conventionalized that it interacts with syntactic constraints.

Sadock argues that “conversational implicature can be conventionalized by stages”(Sadock, 1978, 268), Sadock also points out that conversational principles can be used to account for a large number of additional meanings associated with certain phrases that goes far beyond their literal interpretation. Idioms fall into this category. Even though the meaning of some idioms can be calculated using conversational principles, this doesn't preclude the fact that the idiomatic meaning has become conventionalized. As an example he gives *go to the bathroom* which is now seldom used in its literal meaning involving movement to a room where there is a bathtub. As evidence he gives (18), which has a natural interpretation:

- (18) My dog went to the bathroom on the living room carpet.

The utterance in (18) is a euphemism, and uses implicature to convey something which the speaker wants to avoid saying directly. As Sadock writes “euphemisms fairly rapidly come to mean what they were originally intended to circumlocute, and so cease to be euphemisms”(Sadock, 1978, 287).

A good place to look for examples of conversational implicatures is among taboo-topics, or socially questionable remarks. And indeed, when we look more closer to the examples of cancellation resistant

PCIs, (e.g. (1), (12), (14)) one of the features they share, is that they often involve negative evaluative remarks.

Discussions in which someone's looks, personality or ability are at issue lead to the use of implicatures to communicate negative evaluative statements. The frequent and consistent use of conversational implicatures to convey negative evaluations results in the conventionalization of the implicature as the meaning of the utterance that initially gave rise to the implicature. Now it becomes difficult in conversations about these topics to use that very same expression with its literal meaning.

The following example illustrates an implicature that hasn't become conventionalized yet, but has the potential to be so. The example is found in one of the shows of Herman Finkers, a Dutch comedian.⁵ This example is of particular interest because the speaker explicitly states the reasoning behind the use of the expression *lief kind*.

- (19) Wanneer een kind niet mooi is, dan zou ik niet gaan huichelen. Ja, ik weet ook wel, je kunt ook weer niet zeggen van: “Wat is dat een lelijk kind”. Dat kan niet, moet je ook niet doen. Wat ik altijd doe als een kind niet zo mooi is, dan zeg ik altijd: “Het is een *lief kind*.” Onze burens bijvoorbeeld, die kregen een ontzettend lief kind. Toen heb ik ook heel eerlijk gezegd: “Dit is het liefste kind dat ik ooit heb gezien”
- (20) (our translation) When a baby isn't cute, I wouldn't lie about it. Of course I know that one cannot say: “That is one ugly baby”. One cannot and should not do that. What I always say when a child is not that cute is: “That is a *sweet baby*”. For example, my neighbors just had an extremely sweet child. I told them in all honesty: “This is the sweetest child I have ever seen”

It is clear that the speaker doesn't want to lie. Nor does he want to break the social convention of not telling people that their children are ugly.

4.3. Semi-conventionalized PCIs

We consider cancellation resistant PCIs to be *semi-conventionalized*. Fully conventionalized implicatures are context independent. But this doesn't hold for our examples. When we say that a certain meaning is conventionalized for an expression, we do not

⁵Example taken from the 1990 show: *De zon gaat zinneloos onder, morgen moet ze toch weer op*.

mean to say that this expression has that meaning in every context. Even idiomatic expressions can still, in certain contexts be used in their literal meanings. For instance, *go to the bathroom* can still mean to walk to the room with the bathtub, and not have anything to do with bodily functions. Additionally, even *lets* has its non-literal meaning only in contexts where the speaker has some authority over the addressee. Similarly, it is still possible to say of someone that she has a good personality without conveying that she is unattractive. This is just not possible within a specific context where someone's looks are under discussion.

How does this relate to GCIs? So far in this article we have discussed PCIs of two types: cancelation resistant PCIs and normal PCIs, and we have only briefly mentioned GCIs. GCIs are less context dependent than PCIs, and therefore, they are more conventionalized than PCIs. But they do not exhibit the same resistance to cancelation. What sets GCIs apart from PCIs, is that there is no specific discussion or topic type associated with the use of expressions that give rise to these GCIs; they frequently occur in all types of discussions. Again, we come to the conclusion that the resistance to cancelation is strongly correlated with frequent and consistent use in a specific context.

It is in this respect important to keep two uses of the notion "convention" apart. On the one hand we think of conventional information as context independent meaning, i.e. as always arising, independent of contextual features. Under this view, GCIs are more conventional than PCIs. But on the other hand, we speak of convention when an implicature is associated with the meaning of a certain expression. The implicature it gives rise to immediately arises and isn't cancelable. In this way, PCIs are conventionalized. As we have seen, many conventionalized expressions are context dependent.

5. Conclusion

We have shown that PCIs differ in their ability to be canceled. For some PCIs, the respective cancelation phrase has a strong preference to be interpreted ironically rather than literally, thus preserving the implicature.

This group of cancelation resistant PCIs shares two characteristics that contribute to the difficulty in cancellation. First, they arise from flouting a maxim. Second, they often appear in discussions involving the evaluation of someone's looks or abilities, where consistent use of implicature to communicate negative meaning can quickly lead to the strong association of

this stronger meaning with the expressions used, leading to semi-conventionalization.

What type of data could corroborate these intuitions? Perhaps an elicitation or a reading judgment task, to study how robust these intuitions are among a larger number of speakers. Additionally, a corpus study that shows that implicating expressions, e.g. *she has a good personality* never occur prior to an expression that contradicts the implicature, e.g. *she's very attractive* would suggest that we are on the right track.

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Exhaustification and Semantic Relations in Discourse

Ekaterina Jasinskaja
University of Potsdam

1 Introduction

Exhaustification is a species of conversational implicature that adds to a proposition p the meaning that *only*(p), i.e. that no other proposition from a distinguished domain of quantification holds. In this paper I propose an application of this mechanism to account for the inference of temporal and part-whole relations between events in coherent discourse. Inference of such relations has been a central issue of discourse interpretation theories such as DRT and SDRT, but none of them seems to have considered integrating Exhaustification as an explanatory device. I will argue that Exhaustification can handle the semantic consequences of a class of SDRT discourse relations (Asher and Lascarides, 2003) without having to infer those relations as an intermediate step.

The paper is structured as follows: Section 2 introduces a phenomenon in discourse semantics where Exhaustification can be argued to play a central role. It also presents some informal ideas available in the literature on what this role is. Section 3 implements these ideas in event semantics, whereas Section 4 compares the proposed analysis to the SDRT approach to the same phenomenon.

2 The phenomenon

I concentrate on the semantic contrasts between Russian discourses like (1a) and (1b), cf. their English translations in (2a) vs. (2b), respectively.

When uttered as an answer to a question like *What was Alena doing while Marina was out?*, the most natural interpretation of (1a/2a) is that Alena was cooking raspberry jam and *in doing so* she was fulfilling Marina's assignment, i.e. Marina's assignment for Alena was to cook raspberry jam. This is also a possible interpretation of (1b/2b), however the insertion of the conjunc-

tion *i* 'and' adds another possible reading under which Alena's task is not to cook raspberry jam, but to do something else, e.g. to listen to the broadcast news, and she performs these two activities simultaneously. This latter reading is not available for (1a) as long as both sentences bear a falling "completeness" intonation: (H)L*L% in Russian, comparable to H*L-L% in English.¹ But interestingly, if both clauses are pronounced with a rising "comma" intonation as a kind of open list, the weak simultaneity reading seems to reappear even in the absence of *and*.

- (1) a. Alena varila malinovoe
Alena cook.IMPERF.PAST raspberry
varen'e.
jam
Ona vpolnjala Marinino
she fulfill.IMPERF.PAST Marina's
zadanie.
assignment

- b. Alena varila malinovoe
Alena cook.IMPERF.PAST raspberry
varen'e
jam
i vpolnjala Marinino
and fulfill.IMPERF.PAST Marina's
zadanie.
assignment

- (2) a. Alena was cooking raspberry jam.
She was fulfilling Marina's assignment.
b. Alena was cooking raspberry jam
and fulfilling Marina's assignment.

Thus, apparently, both conjunction and pro-sody play a role in inducing the effect on discourse interpretation illustrated above. This ef-

¹The joint effect of intonation and conjunction was tested for Russian in a pilot perception experiment.

fect has been discussed in various contexts (e.g. Nakajima and Allen, 1993; Swerts and Geluykens, 1994), and given quite an intuitive informal explanation which matches neatly with standard assumptions about the function of rising and falling intonation. Assuming that, roughly, a rise signals “continuation” and a fall signals “completeness”, if an utterance ends with a fall, it is interpreted as “completing” some local communicative goal or topic, i.e. it provides *all* the relevant information wrt. that topic. If after the fall the discourse continues, and there are no reasons to believe that the new utterance addresses a completely different topic, then it can only be interpreted as a kind of “comment” on what has already been said: it can restate, reformulate the previous utterance, but it cannot add anything significantly new. By contrast, a rising continuation tune makes the hearer expect more information to come, so the completion-followed-by-restatement effect does not appear. (See Blake-more and Carston (1999) for an implementation of a similar idea for conjunction *and*.)

Arguably this is what happens in the examples above. The first clause of (1a/2a) ending with a fall gives a complete answer to the question *What was Alena doing?*, so the second clause is just a redescription of Alena’s actions. In contrast, the conjunction *and* in (1b/2b), possibly accompanied with a rising intonation, precludes the first clause from being perceived as a complete answer, and the effect does not arise.

In what follows, I attempt to formalize the explanation presented above. In line with a common view, the communicative goals, or topics, will be understood as *Questions under Discussion* (cf. e.g. Roberts, 1996), and utterances in discourse as answers to those questions. Then the Exhaustification of the answers appears as a rather straightforward way to encode the idea of completeness associated with falling intonation and the absence of a conjunction.

3 The analysis

Semantic representation: The relevant semantic differences between the discourses discussed in the previous section are represented in (3). The expression in (3a) corresponds to the

meaning of (1a/2a), where the second sentence “re-describes” the event introduced by the first sentence, that is, there is an event which is both Alena’s cooking raspberry jam and her fulfilling Marina’s assignment. The reading of (1b/2b) under which Alena’s cooking raspberry jam and her fulfilling Marina’s assignment are two simultaneous but possibly distinct events is represented in (3b). The expression $\tau(e_1) \circ \tau(e_2)$ indicates that the time intervals covered by the cooking event and the fulfilling event overlap.

- (3) a. $\exists e_1 \exists e_2$
 $\|A. \text{ was cooking raspberry jam} \|(e_1) \wedge$
 $\|A. \text{ was fulfilling M.'s assignment} \|(e_2) \wedge$
 $e_1 = e_2$
 b. $\exists e_1 \exists e_2$
 $\|A. \text{ was cooking raspberry jam} \|(e_1) \wedge$
 $\|A. \text{ was fulfilling M.'s assignment} \|(e_2) \wedge$
 $\tau(e_1) \circ \tau(e_2)$

Note that (3b) follows from (3a), since an event overlaps in time with itself, but the reverse does not hold, i.e. if two distinct events have the above properties, it is not necessarily the case that there is a single event that has both properties.² This reflects the less restrictive character of (1b/2b)’s semantics as compared to (1a/2a).³

The SDRT way of representing the semantics of these discourses would be to say that in (1a/2a) the discourse relation between the sentences is *Elaboration*, whereas in (1b/2b) it is something like *Parallel* (cf. Asher and Lascarides, 2003). *Elaboration* ensures that the event described by the second sentence is *part of* the event introduced by the first sentence ($e_2 \leq e_1$), whereas *Parallel* does not have this consequence. Adopting Eckardt’s (1998) notion of a part-whole relation between events ($\leq$), one could say that (3a) entails the semantics of SDRT’s *Elaboration*: $e_1 = e_2 \Rightarrow e_2 \leq e_1$.

Exhaustification and distinctness: Now let’s turn to Exhaustification and the way it in-

²Following Eckardt (1998), persistence of event properties is not adopted in the current analysis, i.e. if $P(e)$ and $e \leq e'$ it is not necessarily the case that $P(e')$. With persistence (3a) and (3b) would be equivalent.

³Note that (3) is intended primarily to capture the semantic contrasts between (1a/2a) and (1b/2b), but not necessarily all their entailments.

duces the event redescription effect, i.e. the (3a) reading of (1a/2a). The Exhaustification operator *Exh* used in the current analysis is defined in (4). The definition says that *Exh* takes a property of events as argument (e.g. $\lambda e.\|A. \text{ was cooking raspberry jam}\|(e)$), and specifies that there is an event that has that property, and that is, roughly speaking, the only event available. Any other events are either part of it (as, for instance, melting sugar is part of cooking jam) or their properties are irrelevant to the current Question under Discussion (QuD). Irrelevant properties are handled by the restriction $Q \in D_{\langle E, t \rangle}$, which makes Exhaustification dependent on a set of (alternative) event properties $D_{\langle E, t \rangle}$ relevant to the current QuD, as is standardly assumed for overt Exhaustification operators such as *only*, cf. Rooth (1992). The requirement $e' \leq e$ on the other hand ensures that subevents are not excluded by Exhaustification, that is, if Alena is only cooking raspberry jam and doing nothing else, this is not to say that she does not melt sugar as part of it. This restriction on exhaustive quantification, proposed by Kratzer (1989), is based on the intuition that when we count, we only count *distinct* entities, and, as we'll see, it plays a crucial role in our analysis of semantic relations in discourse.⁴

$$(4) \text{ Exh}(P) = \exists e. P(e) \wedge \forall e' \forall Q \in D_{\langle E, t \rangle} : Q(e') \rightarrow e' \leq e$$

As was noted in Section 2, falling intonation signals “completeness” of the unit it applies to. In our terms completeness translates into Exhaustification. If two consecutive clauses, as in (1a/2a), both bear a falling tune and there is no other overt indication of connection between them, such as *and*, the Exhaustification operator applies to each of the clauses separately:

$$(5) \text{ Exh}(\lambda e.\|A. \text{ was cooking raspberry jam}\|(e)) \wedge \text{ Exh}(\lambda e.\|A. \text{ was fulfilling M.'s assignment}\|(e))$$

Let's assume that both clauses in (1a/2a) ad-

⁴Though (4) is based on Kratzer's idea, it is different from her intended semantics for *only*, in that it uses $\leq$ on events directly, rather than going via the intermediate notion of *lumping* on propositions. Something similar to (4) was proposed by Bonomi and Casalegno, but the underlying semantics of $\leq$ is in turn different (cf. Bonomi and Casalegno, 1993, p. 20ff).

dress the same QuD and the $D_{\langle E, t \rangle}$ variable in the semantics of *Exh* is instantiated by the same set of event properties. And assume that the properties $\lambda e.\|A. \text{ was cooking raspberry jam}\|(e)$ and $\lambda e.\|A. \text{ was fulfilling M.'s assignment}\|(e)$ are both in that set, i.e. they are both relevant to the current question. Then (5) is equivalent to (6), which in turn entails (3a), the interpretation of (1a/2a) we wanted.

$$(6) \exists e.\|A. \text{ was cooking raspberry jam}\|(e) \wedge \|A. \text{ was fulfilling M.'s assignment}\|(e) \wedge \forall X \in D_{\langle E, t \rangle} [X(e') \rightarrow e' \leq e]$$

Intuitively the derivation goes as follows: *Alena was cooking raspberry jam* bears a falling intonation, so it is a complete answer to *What was Alena doing?* Thus Alena's cooking raspberry jam is the only relevant event that happened, anything else either did not take place or was part of Alena's cooking jam. Then Alena's fulfilling Marina's assignment must be part of her cooking ($e_2 \leq e_1$). Since the clause *Alena was fulfilling Marina's assignment* also ends in a fall, the same derivation applies and we get the part-whole relation to hold in the other direction ($e_1 \leq e_2$). Thus the identity of the cooking and the fulfilling event is inferred.

To sum up, we have derived the event redescription effect with the help of the proposed notion of Exhaustification and without postulating any ontologically primitive discourse relations except the relation of “addressing the same QuD”.

The scope of exhaustification: The discourse (1b/2b) differs from (1a/2a) in that the Exhaustification of the first clause alone is blocked. The presence of *and* or an intonational rise signals that the speaker is not done with the utterance yet, so the hearer should wait with drawing his implicatures. If the second clause then ends in a fall, the *Exh*-operator applies to the whole conjunction, rather than to each of the conjuncts separately.

$$(7) \text{ Exh}(\lambda e.\|A. \text{ was cooking raspberry jam}\|(e) \oplus_* \lambda e.\|A. \text{ was fulfilling M.'s assignment}\|(e))$$

The operator $\oplus_*$, summation of properties of events, corresponds to the meaning of the natural language conjunction *and*, and is adopted from Eckardt (1998), cf. (8). It is not a type-shifted

version of the classical Boolean conjunction, since in addition to conjoining the two event properties, it joins ($\oplus^5$) the corresponding events e_1 and e_2 into one complex event e . This complex event is needed as a handle for further Exhaustification. Although $\oplus_*$ as a semantic correlate of *and* is admittedly a non-standard solution, it is independently motivated, cf. Eckardt's (1998) account of adverbial modification.

$$(8) P \oplus_* Q = \lambda e \exists e_1 \exists e_2 [P(e_1) \wedge Q(e_2) \wedge e = e_1 \oplus e_2]$$

Given (7) and (8), and the definition of Exhaustification (4), the meaning of (1b/2b) results in (9). It says that there are two events, one of Alena's cooking jam and one of her fulfilling Marina's assignment. These events may but need not be identical. Since the whole conjunction is a complete answer to the current QuD, the sum of these two events ($e = e_1 \oplus e_2$) is the only relevant event available, and whatever follows would have to comment on that event.

$$(9) \exists e \exists e_1 \exists e_2. \\ \parallel \text{A. was cooking raspberry jam} \parallel (e_1) \wedge \\ \parallel \text{A. was fulfilling M.'s assignment} \parallel (e_2) \wedge \\ e = e_1 \oplus e_2 \wedge \\ \forall e' \forall X \in D_{\langle E, t \rangle} [X(e') \rightarrow e' \leq e]$$

Note that the temporal overlap of the cooking and the fulfilling event in (3b) does not follow from (9). That is, the simultaneity effect in (1b/2b) has nothing to do with Exhaustification in the proposed sense. Rather it is a consequence of the pragmatics of the Russian imperfective aspect (IMPERF), comparable to the English progressive, or the French *imparfait* (cf. Dowty, 1986; Kamp and Rohrer, 1983). Indeed, if the imperfective is replaced by perfective in (1), the temporal overlap is preserved in (1a) but lost in (1b). This is reminiscent of the observation made for English that verbal aspect affects the inference of temporal relations in discourse in a crucial way, but that this effect is overridden by the temporal consequences of part-whole relations, whenever we have reasons to infer such relations. In contrast with the current analysis, SDRT stipulates this generalization in the inference rule for each discourse

relation of *Elaboration*-type, cf. Asher and Lasnik (2003, p. 206).

Part-whole relations without identity: We have shown above how the relation of identity between events in discourse can be inferred using the mechanism of Exhaustification. But identity is a special case of a part-whole relation. To complete this discussion, it is necessary to note that the proposed formal tools can also be used to infer “one-way” part-whole relations, which is closer to the original SDRT notion of *Elaboration*. For an illustration, consider (10).

- (10) Alena was fulfilling Marina's assignment.
She was cooking raspberry jam
and putting it into jars.

Assuming that the first and the last clause end with a falling intonation, the Exhaustification operator applies to the first clause, and to the non-Boolean conjunction of the second and the third clause, since they are connected by *and*:

$$(11) \text{Exh}(\lambda e. \parallel \text{A. was fulfilling M.'s assignment} \parallel (e)) \wedge \\ \text{Exh}(\lambda e. \parallel \text{A. was cooking raspberry jam} \parallel (e) \wedge \\ \oplus_* \lambda e. \parallel \text{A. was putting jam into jars} \parallel (e))$$

Thus we infer event identity in the usual way. However, it does not hold between all the three events, but only between the event of Alena's fulfilling Marina's assignment (e) and the sum of the other two ($e_1 \oplus e_2$). Consequently, $e_1 \leq e$ and $e_2 \leq e$, but not necessarily $e_1 = e$ or $e_2 = e$.

$$(12) \exists e \exists e_1 \exists e_2. \\ \parallel \text{A. was fulfilling M.'s assignment} \parallel (e) \wedge \\ \parallel \text{A. was cooking raspberry jam} \parallel (e_1) \wedge \\ \parallel \text{A. was putting jam into jars} \parallel (e_2) \wedge \\ e = e_1 \oplus e_2 \wedge \\ \forall e' \forall X \in D_{\langle E, t \rangle} [X(e') \rightarrow e' \leq e]$$

The derived meaning of (10) says that Alena was involved in two (separate) activities—cooking raspberry jam and putting it into jars—and in doing both of these, Alena was fulfilling Marina's assignment, i.e. Marina had told Alena to do both. Cooking jam and putting it into jars are both temporally included in the fulfilling event. This reflects well our intuitive understanding of (10).

⁵The operator $\oplus$ is (spatio-temporally unconstrained) summation of events in the classical sense, cf. Krifka (1989); Eckardt (1998).

Cancellation: Finally, it is necessary to say a few words about all those discourses in which, apparently, the sentences are not connected by a conjunction and end in a falling intonation, yet no event redescription effect appears, as in (13) and (14). Here the sentences present a succession of events, and in SDRT terms are connected by the discourse relation of *Narration*.

- (13) Alena was cooking raspberry jam.
After that, she was fulfilling Marina's assignment.
- (14) Max stood up.
John greeted him.

I propose that in such cases, the absence of event identity is a consequence of implicature cancellation. Recall that Exhaustification is a kind of conversational implicature, so its effect should be cancellable if it is inconsistent with some part of hard-core semantics or the general common knowledge of the interlocutors. In (13), event identity conflicts with the relation of temporal sequence, stated explicitly by the phrase *after that*. In (14), it conflicts with the information that Max standing up and John greeting him cannot be the same event, which is part of world knowledge.

To sum up, a part-whole relation between events induced by Exhaustification is cancelled whenever it is implausible, but if it is plausible, as in (1a/2a) or (10), it also *must* be inferred, unless there are overt intonational or lexical indications that Exhaustification does not apply.

4 Exhaustification vs. SDRT

In the previous section it was shown how the mechanism of Exhaustification can be applied to the inference of part-whole and identity relations between events in discourse, as well as their temporal consequences. Part-whole relations constitute the semantic effect associated with the SDRT relation of *Elaboration*, while event redescription can be considered a special case of *Elaboration*. The proposed analysis accounts for the influence of rising vs. falling intonation as well as presence vs. absence of *and* on the inference of these relations.

In contrast, previous formal accounts have

either ignored the semantic difference between juxtaposed and conjoined clauses (Kamp and Rohrer, 1983; Lascarides and Asher, 1993); or attributed this difference to the semantics of *and* directly (Txurruka, 2003). For instance, Txurruka's SDRT-based proposal assigns the following semantics to the English conjunction *and*:

$$(15) \text{and}(\alpha, \beta) \rightarrow \text{Coordinator}(\alpha, \beta)$$

The rule says that if two clauses are connected by *and* then at the level of conceptual structure they must be connected by a *coordinating* discourse relation. This bars connecting α and β by *Elaboration*, since *Elaboration* is a *subordinating* relation, and the lists of coordinating and subordinating relations are mutually exclusive, cf. (16) and (17).

(16) *List of Coordinators:*

Narration, Result, Parallel, Conditional, ...

(17) *List of Subordinators:*

Explanation, Instance, Background,
Elaboration, Evidence, Generalization,
Reformulation, ...

Here the predictions of Txurruka's and the current analysis coincide, but there are also differences in empirical coverage. On the one hand, Txurruka only handles the effect of the conjunction *and*, but not that of rising intonation. On the other hand, Txurruka's rule for *and* also excludes all other discourse relations listed in (17). Such relations as *Instance*, *Generalization*, *Reformulation*, and possibly *Background* could be argued to involve part-whole relations on events, and therefore fall within the scope of the current Exhaustification-based proposal. But *Explanation* and *Evidence* do not seem to involve such relations, so their tendency to co-occur with bare sentence juxtaposition rather than conjunction *and* is not covered. This tendency is illustrated in (18):

(18) a. Max fell.

He slipped on a banana peel.

b. Max fell

and he slipped on a banana peel.

According to Txurruka and other authors, the second clause in (18a) is most naturally interpreted as the *cause*, i.e. the *Explanation* of Max'

falling, whereas in (18b) this is not the case. The discourse suggests rather that Max fell first, and then slipped on the banana.

Thus the domains of natural language facts covered by Txurruka's (2003) and the current analysis intersect, but neither contains the other. It is outside the scope of the present paper to extend the notion of Exhaustification to treat causal relations. Neither was this paper intended to handle *structural* properties of *Elaboration & Co.*, such as the impact on referential accessibility associated with the distinction between discourse coordination and subordination (see Asher and Vieu (2003) for discussion). However, the *semantic* consequences of *Elaboration* were covered completely and adequately.

To summarize, we proposed an account of the impact of intonation and conjunction on part-whole relations between events in discourse as well as temporal consequences of such relations. The proposal is cast in terms of Gricean conversational implicature and the notion of Question under Discussion, without any reference to discourse relations as ontological primitives. This result is important in light of the following. First, one of Asher and Lascarides's (2003) arguments against approaches based on weaker notions of discourse structure is that they are not able to account for the whole variety of semantic relations that may hold between sentences in discourse. The proposed analysis can be seen as part of the programme to show that this argument does not hold. Second, since the Gricean approach was criticized for its limitation to the treatment of individual sentences and hence (*sic*) its inability to handle relational meaning, it is particularly remarkable that Exhaustification—one kind of Gricean implicature—can be shown to play a central role in an account of semantic *relations* in discourse.

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A modal analysis of expressive meaning: German *ja* under quantifiers

Kratzer (1999) analyzed the German discourse particle ‘*ja*’ at the level of *expressive* meaning and stated that it contributes the assertion that the clause it occurs in is (i) true and (ii) possibly known to the listener. In this connection, Kratzer claimed that ‘*ja*’ cannot intervene between a quantifier and the pronoun it binds, because it must combine with a (presumably closed) proposition. Based on further data from quantificational contexts, we show that this prediction is incorrect. Instead, we argue that the contribution of ‘*ja*’ is best characterized as a *presupposition* (pp), which, however, is harder to accommodate than ordinary pps. We offer an explanation of this peculiarity in a dynamic semantic framework.

We start by observing that (1) with ‘*ja*’, contrary to Kratzer’s claim, is felicitous in a context in which it is common knowledge that all workers were in the union. This casts doubt on Kratzer’s structural explanation for the alleged ill-formedness of the sentence. The pp that all workers were in the union is also carried by (1) without ‘*ja*’, triggered by ‘*because*’. However, the two come apart in (2): the pp of (2a) is the same that of (1) and different from that of (2b). Related differences arise with ‘*ja*’ in the restrictive clause: (3), whose pp is stronger than that of (4), does not have a restrictive reading, unlike (4).

For our analysis we use a dynamic modal logic inspired by Groenendijk et al. (1996). We have three disjoint non-empty sets, W (possible worlds), D (individuals), and $\mathbb{X}$ (potential discourse referents). For simplicity, we assume that the set of active discourse referents is shared between interlocutors and that quantifiers always activate fresh referents (thus we avoid the use of referent systems and pegs). The set of *possibilities* is $I = \{\langle w, g \rangle \mid w \in W, g \in D^X, X \subseteq \mathbb{X}\}$. For each $x \in \mathbb{X}$, an *activation* relation $[x]$ between possibilities is defined as follows: $\langle w, g \rangle [x] \langle w', g' \rangle$ iff (i) $w' = w$, (ii) $x \notin \text{dom}(g)$, (iii) $\text{dom}(g') = \text{dom}(g) \cup \{x\}$, and (iii) $g'(x') = g(x')$ for all $x' \in \text{dom}(g)$. A link $\langle i, j \rangle \in K_a$ subsists in K'_a iff for some j' , $iK'_a j'$ and there is a sequence of zero or more referents $x_1, \dots, x_n$ such that $j([x_1] \circ \dots \circ [x_n])j'$. The information state of an agent a is a relation $K_a \subseteq I \times I$ that is serial, transitive and euclidean (Stalnaker, 2002). Update is defined as follows: (i) $K_a \llbracket P(t_1, \dots, t_n) \rrbracket = \{\langle i, i' \rangle \in K_a \mid \langle g_{i'}(t_1), \dots, g_{i'}(t_n) \rangle \in w_{i'}(P)\}$; (ii) $K_a \llbracket \neg\varphi \rrbracket = \{\langle i, i' \rangle \in K_a \mid \langle i, i' \rangle \text{ does not subsist in } K_a \llbracket \varphi \rrbracket\}$; (iii) $K_a \llbracket \exists x \rrbracket = (K_a \circ [x]) \cup \{\langle i', j' \rangle \mid \text{for some } \langle i, j \rangle \in K_a, i[x]i' \text{ and } j[x]j'\}$ (the second part ensures that factual beliefs are preserved under referent activation); (iv) $\llbracket \varphi \wedge \psi \rrbracket = \llbracket \varphi \rrbracket \circ \llbracket \psi \rrbracket$. Also, $\llbracket \varphi \rightarrow \psi \rrbracket = \llbracket \neg(\varphi \wedge \neg\psi) \rrbracket$ and $\llbracket \forall x \varphi \rrbracket = \llbracket \neg(\exists x \wedge \neg\varphi) \rrbracket$. Agent a knows φ , written $[K_a]\varphi$, iff $K_a \llbracket \neg\varphi \rrbracket$ is not serial. The common ground $K_{s,\ell}$ between speaker s and listener ℓ is the transitive closure of $K_s \cup K_\ell$.

We account for the observations as follows. Let ‘*ja*(φ)’ be the clause containing ‘*ja*’ in (2a). Its descriptive content is φ ; its presupposition is $[K_{s,\ell}]\varphi$, ‘ φ is (already) common knowledge’ — in particular, ‘*I (the speaker) know that you know that φ is true*’. Assuming that x is the discourse referent activated by the quantifier, φ is ‘ *x was in the union*’. In order for this to already be common knowledge, s has to believe that ℓ does not entertain the possibility that x refers to a worker who was not in the union. But for the state resulting from the update with $\llbracket \exists x \rrbracket \circ \llbracket \text{worker}(x) \rrbracket$ to exclude this possibility, ℓ must have known beforehand that all workers were in the union.

Suppose ℓ did not already know this and attempts to accommodate the presupposition. Updating K_ℓ with φ will indeed make it common belief that x was in the union, but it does not resolve the disagreement, since it fails to remove those possibilities in which a worker not referred to by x was not in the union. Nor should ℓ update K_ℓ with $[K_{s,\ell}]\varphi$ (by eliminating from K_ℓ all links $\langle i, i' \rangle$ such that for some i'' with $i'K_{s,\ell}i''$, φ is false at i''), which would result in inconsistency.

If ℓ wants to fully restore agreement about the common ground, she must fix her beliefs in such a way that the update with $\llbracket \exists x \rrbracket \circ \llbracket \text{worker}(x) \rrbracket$ would have led her to conclude φ (i.e., a post-hoc update with the information that all workers were in the union). This requires some complex inference.

Alternative, ℓ might accept φ but reject s 's claim that φ followed from $\llbracket \exists x \rrbracket \circ \llbracket \text{worker}(x) \rrbracket$. This need not disrupt the conversation, but the disagreement about the common ground will persist.

Things are simpler with the pp in 'ja'-less (2b), triggered by 'because'. This pp is φ . If it fails in K_ℓ , it can easily be accommodated by updating with φ . It is then common knowledge that x was in the union, though not that every worker was. There is no problem here because unlike in (2a), s does not give any indication that he believes so.

We call the contribution of 'ja' a presupposition for two reasons: (i) (3) shows that it includes the pps of φ (thus what s conveys he assumes is not that all workers who were married loved their wives), and (ii) it must be satisfied in the same local context as the pps (if any) of its 'ja'-less counterpart: In (2), this is the point at which ' x lost his job because x was in the union' is processed, and as a result, the presupposition is that all workers were in the union, not all workers who lost their jobs. In contrast, (5) presupposes that all workers who blew the whistle lost their jobs. This difference deserves further exploration, as it may bear on the question of how discourse relations between sentences should affect the way they are processed in update semantics.

- (1) Jeder dieser Arbeiter hat seinen Job verloren, weil er (ja) in der Gewerkschaft war.
each of these workers has his job lost because he JA in the union was
 Each of these worker lost his job because he was (JA) in the union.
 >> All (of these) workers were in the union.
- (2) a. Ein Arbeiter hat seinen Job verloren, weil er ja in der Gewerkschaft war.
 A worker lost his job because he was JA in the union.
 >> All workers were in the union.
 b. Ein Arbeiter hat seinen Job verloren, weil er in der Gewerkschaft war.
 A worker lost his job because he was in the union.
 >> A worker was in the union.
- (3) Ein Arbeiter, der ja seine Frau liebte, verlor seinen Job.
 a worker who JA his wife loved lost his job
 a. ✓A worker, who JA loved his wife, lost his job. [non-restrictive]
 b. ✗A worker who JA loved his wife lost his job. [restrictive]
 >> All workers were married and loved their wives.
- (4) Ein Arbeiter, der seine Frau liebte, verlor seinen Job.
 a. ✓A worker, who loved his wife, lost his job. [non-restrictive]
 b. ✓A worker who loved his wife lost his job. [restrictive]
 >> A worker was married and loved his wife.
- (5) Ein Arbeiter verpfeff seinen Chef und verlor ja daraufhin seinen Job.
 a worker bewhistled his boss and lost JA thereupon his job
 A worker blew the whistle on his boss and lost JA his job as a result.
 >> All workers who blew the whistle on their bosses lost their jobs.

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Investigating Scalar Implicature

Nausicaa Pouscoulous, Ira Noveck,
Institut des Sciences Cognitives CNRS, Lyon

Implicatures are intentionally communicated assumptions which go beyond the explicit content of the utterance. We focus on a particular sub-class of implicatures: scalar implicatures. These occur when a speaker chooses to articulate a weaker word on a lexical scale of informativeness in such a way that the hearer believes that the speaker intended not to use a stronger one. For example, *Some* is a weaker quantifier than *All* and an utterance like *Some children have teddy bears* can be taken to imply that *Not all children have teddy bears* (likewise, *or* is a weaker term than *and* on the same semantic scale, and *decent* is weaker than *excellent*; so that in hearing ‘John will go to Canada *or* Ireland’ we understand he will not go in both countries, and if someone says ‘The meal was *decent*’ we understand she didn’t find it *excellent*).

A variety of semantic and pragmatic analyses of scalar implicatures have been proposed. We will focus on the difference between two cognitively oriented accounts: the neo-Gricean and the Relevance theoretic accounts. According to Levinson (2000) and some other neo-Griceans, scalar implicatures are default inferences triggered by certain words or expressions such as ‘some’. The inference is assumed to be drawn automatically and largely independently of context (context can indicate that the implicature should be cancelled). However, Relevance theorists (e.g. Sperber and Wilson 1985/1996; Carston 1998) do not assume that there is a default meaning for expressions involving words such as ‘some’ or that implicatures are automatic. Rather, the decision is determined each time by the given context: a hearer will choose to draw the implicature only if it gives him more cognitive effects than the interpretation that follows from its linguistically encoded meaning without too much extra effort.

We present two developmental experiments investigating when children use scalar implicatures. These studies follow up on work carried out by Noveck (2001; also see Chierchia et al 2001; Papafragou 2003), who showed that children do not draw implicatures as readily as adults and tend to interpret a weaker word as compatible with its stronger equivalent (i.e., children interpret *some* to be consistent with *all*). Experiment 1 generalised the findings from Noveck by using a novel methodology to demonstrate the same trend. These results can be accounted for by both of the theories discussed above. From the neo-Gricean perspective, it could be claimed that scalar implicatures become automatic with development. In contrast, Relevance theory would suggest that greater cognitive resources are available for adults, which in turn encourages them to take advantage of the greater cognitive effects that can arise with the implicature.

Experiment 2 aimed to establish that the implicature production is not linked to specific age, but rather to task complexity. A simpler task that is more readily understandable ought to make implicature production more likely. Such a finding would have to be considered favorable to Relevance Theory because it would indicate that relative effort is critical for implicature production. If scalar implicatures were automatic, task complexity ought not to matter. Experiment 2 made three procedural changes which we believe would reduce the effort necessary to perform the task, thus encouraging pragmatic responses in children. The results showed that even very young children (e.g. 4-year-olds) can make implicatures in tasks

that minimise cognitive effort. The fact that effort plays an important role in the recovery of implicature is particularly well accounted for by Relevance Theory whereas there does not seem to be any clear account for our results originating from the neo-Gricean approach.

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AGAINST GRAMMATICAL COMPUTATION OF SCALAR IMPLICATURES

Benjamin Russell (brussell@brown.edu)

Brown University, Department of Cognitive and Linguistic Sciences

1 Introduction

Scalar implicatures (SIs), according to a theoretical tradition that goes back to Grice (1975) and is elaborated and formalized by Horn (1972, 1989), Gazdar (1979), Sauerland (2004), and Blutner (2004), have been understood as inferences of the following (somewhat abbreviated) form:

- (1) Speaker A said ϕ , and could as easily have said ψ , which is stronger. Because A is cooperative, she makes the strongest true statement possible, so ψ can't be true.

Recently, Chierchia (to appear) (henceforth C) has proposed a radical departure from the Gricean theory: SIs, he argues, are not the product of rational behavior between cooperative conversants as in (1), but rather are computed automatically in the grammar by means of special semantic composition rules and lexical scales. He argues that reformulating the process of SI computation in this way has two advantages: it accounts for the generation of a class of SIs that the Gricean theory doesn't; and negative polarity item licensing, a grammatical process, is sensitive to SIs, which are available to grammatical processes under his theory but not under a Gricean theory. I will argue that, despite the ingenuity of C's formalism, neither of his arguments for adopting it is valid. I show that a Gricean theory can account for each of the implicatures C identifies, and that negative polarity item licensing is not affected by SIs. Thus, the empirical predictions of C's theory, which requires the stipulation of a secondary semantic composition system, do not surpass the empirical predictions of the Gricean theory, which assumes only that speakers are cooperative.

2 Gricean computation of implicatures of complex sentences

C's first argument consists in identifying a range of observed SIs that are not obviously generated by Gricean principles. The most compelling of these are apparently embedded implicatures of the following form.

- (2) George believes some of his advisors are waiting.
 a. $\rightsquigarrow$ George believes not all of his advisors are waiting.
 b. $\nrightarrow$ It is not the case that George believes all of his advisors are waiting.

C argues that Gricean reasoning cannot generate the observed implicature in (2a); if SIs are derived by the kind of reasoning in (1), hearers can only make conclusions about the negation of competing utterances, not embedded

clauses within those utterances, and so they should only infer (2b). On the other hand, in C's system, the implicature of *some of his advisors are waiting* is computed to give a strong meaning of *some of his advisors are waiting and not all of his advisors are waiting*, which subsequently combines with *George believes* to give a strong meaning of *George believes some of his advisors are waiting and not all of his advisors are waiting*. Thus, by grammaticizing the process of SI computation, C is able to correctly compute embedded SIs like (2a).

But notice that (2a) follows from (2b) in every context where George has SOME belief about whether all of his advisors are waiting: if it is not the case that George believes that all of his advisors are waiting, but George has some belief about whether all of his advisors are waiting, then George must believe that not all of his advisors are waiting. Furthermore, in a context where this assumption is explicitly denied, the embedded implicature is not generated. For example, if George has four advisors and has an appointment with Dick and Donald, but has no idea whether his other two advisors, Colin and Condoleezza, will be waiting for him, the utterance *George believes some of his advisors are waiting for him* only implies (2b), not (2a). The enrichment of weak implicatures with contextual inferences in a global, Gricean framework correctly mirrors the observed fine-grained context-sensitivity of scalar implicatures. And the fact that Gricean inferencing CAN generate ostensibly embedded implicatures as well as weaker global implicatures obviates the need C tries to establish for a compositional system of implicature computation.

C further argues that the Gricean theory incorrectly predicts (3) implicates (3b), not (3a).

- (3) George ate some of the fries or the apple pie.
- a. $\rightsquigarrow$ It is not the case that George ate all of the fries.
 - b. $\nrightarrow$ It is not the case that George ate all of the fries or the apple pie.

Following Sauerland (2004), I propose that a reconsideration of the epistemic status of implicatures provides a solution to this problem; I reiterate Sauerland's insights about sentences like (3) here in general Gricean terms. Sauerland follows Horn (1989) and Soames (1982) in recognizing that the Gricean reasoning for SI computation in (1) is more accurately represented as (4).

- (4) Speaker A said ϕ , and could as easily have said ψ , which is stronger. Because A is cooperative, she makes the strongest true statement possible, so **A must not know ψ is true** ($\neg K\psi$).

Under this view, scalar implicatures are weaker inferences of the form $\phi \rightsquigarrow \neg K\psi$, rather than $\phi \rightsquigarrow K\neg\psi$. Implicatures are only strengthened to $K\neg\psi$ when the hearer assumes that the speaker knows WHETHER ψ is true

$(\mathbf{K}\psi \vee \mathbf{K}\neg\psi)$. This increased fidelity to Grice’s theory provides a solution to C’s puzzle, for (3) now has the implicature in (5).

(5) $\neg\mathbf{K}$ George ate all of the fries or the apple pie.

And (5) entails the following two epistemic facts about the speaker.

- (6) a. $\neg\mathbf{K}$ George ate all of the fries.
 b. $\neg\mathbf{K}$ George ate the apple pie.

In contexts where the hearer can assume the speaker knows whether George ate all the fries, (6a) can be strengthened, yielding the desired implicature in (3a). In all other contexts, (6a) is the strongest implicature drawn, which is very much in keeping with my intuitions.

This analysis presents two potentially contentious points. First, do hearers actually freely strengthen entailments of implicatures? Sauerland’s specific formalism prevents this question from arising—but in the general Gricean framework employed here, I propose that if $\neg\mathbf{K}$ implicatures can be strengthened, their entailments should also be strengthenable. The logic of this is as follows: the process of inferring an implicature is no more and no less than attributing a mental state to your conversational partner. So, if B infers that A has the state $\neg\mathbf{K}\psi$, and $\phi \subset \psi$, then A must also have the state $\neg\mathbf{K}\phi$ (otherwise, A would have to know ψ). Then, B can infer $\mathbf{K}\neg\phi$ whenever B has reason to think that A is well-informed about ϕ . The second contentious question is: why isn’t (6b) strengthened to the obviously undesirable inference (7)?

(7) $\mathbf{K}\neg$ George ate the apple pie.

Sauerland finds the answer to this in another set of implicatures of (3): the implicatures Gazdar referred to as *clausal implicatures*, which, in the case of disjunction, are of the form $p \vee q \rightsquigarrow \neg\mathbf{K}p \wedge \neg\mathbf{K}q$. Following Sauerland, I think clausal implicatures may generally be understood as a class of scalar implicatures: both p and q are stronger than (entail) $p \vee q$, and p and q are each certainly easier to say than p or q , so if a speaker has chosen to use p or q , she must not know that either p or q is true. Thus, the weak implicatures in (8) should be generated with the weak implicatures in (5).

- (8) a. $\neg\mathbf{K}$ George ate some of the fries.
 b. $\neg\mathbf{K}$ George ate the apple pie.

This set of implicatures is enough to “block” the strengthening of (6b) to (7). The derivation is as follows:

- (9) a. $\mathbf{K}$ (George ate some of the fries $\vee$ George ate the apple pie)
 (from (3))
 b. $\mathbf{K}(\neg$ George ate the apple pie $\rightarrow$ George ate some of the fries)
 (equivalent to (9a))
 c. $\mathbf{K}\neg$ George ate the apple pie $\rightarrow \mathbf{K}$ George ate some of the fries
 (from (9b) by axioms of epistemic logic)

- d. $\neg\mathbf{K}$ George ate some of the fries $\rightarrow \neg\mathbf{K}\neg$ George ate the apple pie (contrapositive of (9c))
- e. $\neg\mathbf{K}$ George ate some of the fries (from (8a))
- f. $\neg\mathbf{K}\neg$ George ate the apple pie (modus ponens)

So (7) is blocked and the observed implicature (3a) is generated by the Gricean theory without any undesirable consequences. The Gricean theory is again capable of generating the right implicatures for complex sentences, and C's argument that the observed implicatures of sentences like (2) and (3) are not generated by a global theory is thus countered.

3 Scalar Implicatures and Intervention

C's second argument for a local theory is that an adequate treatment of intervention in negative polarity item (NPI) licensing depends on SIs. NPIs (like *any*) are licensed by downward-entailing operators—an operator f is downward entailing if for any $\alpha \subset \beta$, $f(\alpha) \supset f(\beta)$; examples are *not*, *doubt*, and *if* (Ladusaw 1979). *Intervention* is an exception to the licensing of NPIs by downward-entailing operators: *any* is not licensed by downward-entailing operators if it appears in the scope of *every* or as one of the conjuncts of *and*:

- (10) a. *Condoleeza didn't drink any Coke and a milkshake. (cf. Condoleeza didn't drink any Coke or a milkshake.)
- b. *Dick doubts everyone ate any McNuggets. (cf. Dick doubts anyone ate any McNuggets.)

Though semantic theories of NPI licensing have been very successful, C is among the first to propose a semantic solution to the intervention puzzle (but cf. Honcoop (1996)). C's solution is predicated on Kadmon and Landman's (1993) semantics of *any*, whereby *any* means approximately the same thing as *some*, but $\llbracket \text{some} \rrbracket \subset \llbracket \text{any} \rrbracket$; K&L call this part of their theory Widening. The second part of K&L's theory is a condition they call Strengthening: given a sentence S_{any} containing *any*, it must be the case that $S_{any} \subset S_{some}$, where S_{some} is identical to S_{any} , except *some* is substituted for *any*. Widening and Strengthening combined predict that *any* will be licensed by downward entailing operators. Crucially, this licensing must be grammatical, because Widening and Strengthening make the wrong predictions about *any*-licensing at the global level. In particular, sentences like (11) do not globally satisfy Strengthening.

- (11) If Colin doesn't have any money, he can't buy a Big Mac.

Because both *if* and *not* are downward-entailing, *any* appears globally in an upward-entailing environment in (11). So *any* must be licensed before it the expression containing it combines with *if*, while it still satisfies K&L's Strengthening condition. This conclusion that NPIs must be grammatically

licensed is the foundation of C's argument that his SI-based solution to the intervention puzzle suggests SIs are grammatically computed.

C's NPI theory assumes K&L are basically correct but modifies their Strengthening condition, incorporating implicature-enriched *strong meanings*. A *strong meaning* is the conjunction of the regular semantics of an expression with its locally-computed scalar implicatures; given an expression α , the strong meaning of α is notated α^s . C's Strong Strengthening condition is $S_{any} \subset S_{some}^s$; in prose, the condition is that the meaning of a sentence with *any* must be stronger than (entail) the strong meaning of the corresponding sentence with *some*. Now, in (10a), $S_{some}^s = \text{Condoleeza didn't drink some Coke and a milkshake, but she drank some coke or a milkshake}$, so, in particular, for *any* to be licensed, S_{any} —i.e. (10a)—must entail *Condoleeza drank some Coke or a milkshake*. S_{any} does not entail this, so Strong Strengthening is not satisfied, and (10a) is ungrammatical.

Notice that Strong Strengthening requires S_{any} to entail not only S_{some} , but also the implicatures of S_{some} . And, as seen in (10a), both S_{any} and S_{some} implicate *Condoleeza drank some coke or a milkshake*, and so Strong Strengthening here is actually a requirement that the sentence with *any* entail its own SI. In fact, this is the case for all the intervention cases C discusses, and can be proved to be the case for a broad class of intervention cases. And sentences do not entail their own scalar implicatures, by definition. So Strong Strengthening amounts to a restriction that *any* may not be licensed in sentences with scalar implicatures. That is, in C's theory, *and* and *every* are interveners simply because they have SIs when embedded below downward-entailing operators.

This leads to my final conclusion about intervention. C's theory predicts that every item that has SIs when embedded below a downward-entailing operator will be an intervener. So, in addition to *and* and *every*, the set of interveners should include every strong scalar term, like *necessarily*, *excellent*, and numerals (if you believe in the Gricean *at least n* treatment of numerals) because no sentence with one of these items below a single downward-entailing operator will satisfy Strong Strengthening. But this prediction is contradicted by empirical data:

- (12) a. Donald won't necessarily eat any cheeseburgers.
- b. George doubts anyone ate a Big Mac and a Quarter Pounder.

In (12a), S_{some} implies *Donald will possibly eat some cheeseburgers*. So Strong Strengthening requires that S_{any} —i.e. (12a)—entail that *Donald will possibly eat some cheeseburgers*. But, of course, this is an implicature, and not an entailment. Likewise, in (12b), S_{some} implies *George doesn't doubt someone ate a Big Mac or a Quarter Pounder*, which, in turn, is not entailed by S_{any} , and so Strong Strengthening is not satisfied. This example is especially striking because it shows that *and* is only an intervener when *any* appears in one of its conjuncts—not in the broader set of circumstances

where the implicatures of *and* are computed before *any* is licensed by a downward-entailing operator, as C predicts. C's theory thus incorrectly predicts that both sentences in (12) are ungrammatical, suggesting that it is not the SIs associated with *and* and *every* that are responsible for their behavior as interveners.

4 Conclusion

C's proposal to grammaticize the computation of SIs is a radical departure from Gricean pragmatics. If C is right, SIs have nothing to do with rational principles of cooperation in conversation. Instead, this broad class of inferences that can be explained by the simple assumption that speakers cooperate is redundantly generated by a stipulated grammatical mechanism. C's argument for the radical shift to a grammatical theory of implicature computation depends on two claims. First, he claims that observed implicatures of embedded sentences are predicted by his local theory but not by global theories. I've argued that a very general global Gricean theory accounts for all such implicatures. Second, he develops a theory of intervention in NPI licensing that depends on grammatically computed SIs; I've argued that any theory that depends on SIs to exclude intervention cases is too stringent, failing to license *any* in many grammatical sentences. I conclude that the departure from Gricean pragmatics that C proposes is unmotivated.

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Exhaustive interpretation of complex sentences[†]

Robert van Rooij and Katrin Schulz

Abstract. In terms of Groenendijk & Stokhof's (1984) formalization of exhaustive interpretation, many conversational implicatures can be accounted for. In this paper we justify and generalize this approach. Our justification proceeds by relating their account via Halpern & Moses' (1984) non-monotonic theory of 'only knowing' to the Gricean maxims of Quality and the first sub-maxim of Quantity. The approach of Groenendijk & Stokhof (1984) is generalized such that it can also account for implicatures that are triggered in subclauses not entailed by the whole complex sentence.

1. Introduction

One of the most influential pragmatic theories of this century is the theory of conversational implicatures proposed by Grice (1967). It has not only been applied to various semantical problems, but also received considerable attention in philosophy and the social sciences. The main purpose of this theory was to defend a simple, truth-conditional approach to semantics, particularly to the meaning of sentential operators and quantificational phrases. Traditionally, the semantic meaning of natural language expressions like 'and', 'or', 'every', 'some', 'believe', and 'possibly' has been analyzed in terms of their intuitive analogs in classical logic: ' $\wedge$ ', ' $\vee$ ', ' $\forall$ ', ' $\exists$ ', ' $\square$ ', and ' $\diamond$ ', respectively. However, in many contexts these expressions receive interpretations that are different from what is predicted by this approach to their semantics. It turned out to be extremely difficult to come up with an alternative semantic theory that can account for the observed interpretations. This led some ordinary language philosophers such as Ryle and Strawson even to question the logical approach to natural language semantics in general.

According to Grice (1967), the mistake in this line of reasoning is the assumption that the problematic interpretations have to be explained by semantics only. He proposes to single out within the 'total significance' of a linguistic utterance the class of *conversational implicatures*. Grice takes conversational implicatures (from now on: implicatures) to be not part of the semantic meaning of an utterance, but to be due to principles of pragmatics. More particularly, they are inferences an interpreter can draw from taking the speaker to behave rationally in

[†] The full paper will appear in the Journal of Logic, Language, and Information.

a cooperative conversational situation. According to Grice, this means that the speaker is assumed to obey certain rules that govern such behavior: the *maxims of conversation*. The idea, then, is to account for the interpretation of sentential operators and quantificational expressions in terms of both their semantic meaning as described in classical logic and a set of conversational implicatures.

While Grice's notion of conversational implicature is generally accepted, his proposal concerning the way these inferences are determined is still under debate. One central issue is the question whether (i) the conversational implicatures of an utterance are generated globally, after the grammar assigned a meaning to it, or, whether (ii) the generation refers to intermediate states of the grammar-driven semantic derivation. Following Grice's theory one should adopt the first position. However, it has been argued that a global derivation is not able to account for the implicatures actually observed (Landman (2000), Chierchia (ms)). The central argument brought forward by defenders of a local derivation is the behavior of implicatures in complex sentences, where the expression whose interpretation is to be explained is embedded under other sentential operators or quantificational expressions. For instance, the semantic meaning of numerals such as '100' is often analyzed as 'at least 100' and then conversational implicatures are taken to be responsible for the 'exactly'-reading these expressions often receive. Chierchia now claims that globalists cannot explain why sentence (1) is normally interpreted as implying that John believes that his colleague makes not more than \$100 an hour, hence, why the numeral in scope of the belief-operator receives an 'exactly'-interpretation.

- (1) John believes that his colleague makes \$100 an hour.

A closer investigation of the argumentation of the localists Landman (2000) and Chierchia (ms) reveals that they discuss only one particular approach to a global description of certain conversational implicatures: the simple scalar approach. Theories that fit into this scheme assume that sentences can be associated with *expression scales* (ordered sets of expressions). They derive the conversational implicatures of an utterance of sentence *s* as follows. If *s* contains an item *i* from an expression scale that *s* can be associated with, let *s'* be a sentence one obtains by replacing *i* in *s* by another element of this scale that is ranked higher than *i*. Then *s* conversationally implies *not s'*. Such a kind of derivation is, for instance, proposed in Horn (1972). The conversational implicatures these theories aim to describe are now generally called – after this approach – *scalar implicatures*. To give a concrete example of a derivation, the simple scalar approach can, for instance, account for the exactly-readings of numerals occurring in simple sentences such

as ‘John’s colleague makes \$100 an hour’. Assume that the sentence is associated with the scale containing the numerals and ordered by increasing height. Then its utterance is predicted to conversationally imply that John’s colleague does not earn more than \$100 an hour. Together with the asserted meaning that John’s colleague earns *at least* \$100 an hour we derive the *exactly* interpretation. The simple scalar approach easily gets into trouble with examples such as (1). The only implicature derivable this way is that John did not believe that his colleague makes more than \$100 an hour. This does not give us the exactly-reading of the embedded numeral that we intuitively perceive.

However, the argumentation of localists such as Landman and Chierchia would only be conclusive if they could show that *all* global accounts get into this kind of trouble. But the simple scalar approach that they criticize is not the only possible theory of this kind. A quite different global account has been introduced by Groenendijk & Stokhof (1984). Even though they address the exhaustive interpretation of answers, and not directly conversational implicatures, their description of exhaustivity is able to account for many phenomena analyzed under the latter heading, in particular for scalar implicatures. Except for its appealing predictions, this proposal also overcomes other shortcomings of previous approaches to conversational implicatures, such as the neglect of contextual interactions and dependence on the conceptually difficult notion of expression scales/alternatives. Recently, it has been shown (van Rooij & Schulz, submitted) how some well-known problems faced by Groenendijk & Stokhof’s (1984) account can be overcome by using results from decision theory and dynamic semantics.

In this article we will study whether this approach can deal with conversational implicatures of complex sentences. We will see that while it easily accounts for some of the counterexamples to the simple scalar approach brought forward by localists, other predictions it makes are not satisfying. We will then develop a generalization of the approach that can deal with the problematic cases.

At the same time, the generalization will address another open question. While the work of Groenendijk & Stokhof (1984) and van Rooij & Schulz (submitted) provide us with a powerful formal description of exhaustive interpretation and many conversational implicatures, neither of these works gives us a satisfying theory of the conceptual status of the inferences that they describe. Are they part of the semantic meaning? Are they products of pragmatic rules? Can they be explained by Grice’s theory, hence, as due to taking the speaker to obey the maxims of conversation? As we will see, the generalization of Groenendijk & Stokhof’s (1984) approach we are going to develop can be interpreted

as formalizing some of the maxims of conversation.¹ Thereby it links Groenendijk & Stokhof's (1984) exhaustivity operator to Grice's theory of conversational implicatures.

The rest of the paper is organized as follows. The next section will be dedicated to a discussion of the subtle data of implicatures in complex sentences. We will then introduce Groenendijk & Stokhof's (1984) approach to exhaustive interpretation in section 3 and discuss the predictions it makes concerning implicatures of complex sentences. Afterwards, a new pragmatic interpretation function is defined that tries to capture parts of Grice's theory of conversational implicatures. We will show that it contains Groenendijk & Stokhof's account as a special case. The fifth part is devoted to the application of the introduced framework to various problems involving conversational implicatures of complex sentences. We conclude with a discussion of the results.

2. Definitions and facts of sections 2, 3, 4. Section 5 omitted

$$exh(F, B) =_{def} F(B) \wedge \neg \exists B' \subseteq D : F(B') \wedge B' \subset B$$

$$CIRC(A, P) \equiv_{def} A \wedge \neg \exists P' \subseteq D : A[P'/P] \wedge P' \subset P$$

It is obvious that $exh(F, B)$ can be obtained from $circ(A, P)$ by taking B for P and A to be $F(B)$, hence instead of the term-answer, the sentential answer.

FACT 1.

$$\forall w \in W : w \models CIRC(A, P) \Leftrightarrow w \models A \wedge \neg \exists v \in W : v \models A \wedge v <_P w.$$

This fact shows that we can equivalently describe predicate circumscription by the interpretation function $circ^W(A, P)$ defined as follows.

$$circ^W(A, P) =_{def} \{w \in W | w \models A \wedge \neg \exists v \in W : v \models A \wedge v <_P w\}$$

DEFINITION 1.

For all $s_1 = \langle M_1, w_1 \rangle, s_2 = \langle M_2, w_2 \rangle \in \mathcal{S}$:

$$\begin{aligned} s_1 \preceq_{\square} s_2 & \text{ iff}_{def} \quad \forall v_2 \in R_2[w_2] \exists v_1 \in R_1[w_1] \\ & \quad V_1(P)(v_1) \subseteq V_2(P)(v_2) \\ s_1 \cong_{\square} s_2 & \text{ iff}_{def} \quad s_1 \preceq_{\square} s_2 \text{ and } s_2 \preceq_{\square} s_1 \end{aligned}$$

¹ Part of this observation can also be found in Spector (2003).

DEFINITION 2. (*The Epistemic Weak Reading*)

Given a sentence A of $\mathcal{L}$ and a predicate P , we define the pragmatic meaning $eps_1^S(A, P)$ of A with respect to P and a set of states S as follows:

$$eps_1^S(A, P) =_{def} \{s \in S \mid s \models \Box A \wedge [\forall s' \in S : s' \models \Box A \rightarrow s \preceq_{\Box} s']\}$$

To model maximizing competence we will use the same strategy as for minimizing knowledge. We take $\preceq_{\Diamond}$ to denote the order defined as follows:

DEFINITION 3.

For all $s_1 = \langle M_1, w_1 \rangle, s_2 = \langle M_2, w_2 \rangle \in \mathcal{S}$:

$$\begin{aligned} s_1 \preceq_{\Diamond} s_2 & \text{ iff}_{def} \quad \forall v_1 \in R_1[w_1] \exists v_2 \in R_2[w_2] \\ & \quad V_1(P)(v_1) \subseteq V_2(P)(v_2) \\ s_1 \cong_{\Diamond} s_2 & \text{ iff}_{def} \quad s_1 \preceq_{\Diamond} s_2 \text{ and } s_2 \preceq_{\Diamond} s_1 \end{aligned}$$

We define a new pragmatic interpretation function, $eps_2^S(A, P)$, that strengthens $eps_1^S(A, P)$ by selecting among the states in $eps_1^S(A, P)$ those that are minimal with respect to $\preceq_{\Diamond}$.

DEFINITION 4. (*The Epistemic Strong Reading*)

Given a sentence A of $\mathcal{L}$ and a predicate P , we define the pragmatic meaning $eps_2^S(A, P)$ of A with respect to P and a set of states S as follows:

$$\begin{aligned} eps_2^S(A, P) &=_{def} \{s \in S \mid s \models \Box A \wedge [\forall s' \in S : s' \models \Box A \rightarrow [s \preceq_{\Box} s' \wedge \\ & \quad (s \cong_{\Box} s' \rightarrow s' \not\preceq_{\Diamond} s)]]\} \\ &= \{s \in eps_1^S(A, P) \mid \forall s' \in eps_1^S(A, P) : s' \not\preceq_{\Diamond} s\} \end{aligned}$$

FACT 2. For $A \in \mathcal{L}^0$ and P a predicate of $\mathcal{L}$, $eps_2^S(A, P)$ implies circumscription of the predicate P with respect to A and $\mathcal{S}$:

$$eps_2^S(A, P) \subseteq circ^S(A, P).$$

$$circ_2^S(A, P) =_{def} \{s \in S \mid s \models A \wedge \neg \exists s' \in S : s' \models A \wedge s' \leq_P^2 s\}$$

For this version of circumscription we can indeed establish not only an analogue claim to fact 2 but additionally the following result:

FACT 3. Let A be an element of $\mathcal{L}^0$ and P a predicate of $\mathcal{L}$. Assume that for all $s \in \mathcal{S}$ such that $s \models A$ there is some $s' \in circ_2^S(A, P)$ such that $s' \leq_P^2 s$. Then we have:

$$\forall \phi \in \mathcal{L}^0 : eps_2^S(A, P) \models \phi \Rightarrow circ_2^S(A, P) \models \phi.$$

3. Conclusion

In this paper we introduced two related pragmatic interpretation functions for answers to overt questions. The first function, *eps*₁, was motivated directly by Grice’s theory of conversational implicature and intends to describe conversational implicatures due to the maxims of Quality and the first sub-maxim of Quantity. The second, *eps*₂, was obtained by strengthening *eps*₁ with an additional principle to maximize the competence of the speaker. In both cases the definition makes crucial use of the work of Halpern & Moses (1984) on ‘only knowing’ and its recent generalization by van der Hoek et al. (1999, 2000).

These two functions predict two different pragmatic readings for answers to overt questions. *eps*₁ describes the conversational implicatures that are always obtained if the speaker is taken to obey the maxim of Quality and the first sub-maxim of Quantity. The predicted inferences have weak epistemic force and say, roughly, that for certain stronger statements the speaker does not know whether they are true. The interpretation function *eps*₂ strengthens *eps*₁ in the contexts where the interpreter can make additional assumptions about the competence of the speaker. This strengthening has the result that some of the inferences of *eps*₁ are now generated with a strong epistemic force, claiming that the speaker knows that certain claims that are stronger than the statement made by the speaker are not true. As these paraphrases show, the implicatures predicted by our approach are closely related to many other descriptions of these inferences given in the literature. The specific advantages of our proposal, we claim, are, on the one hand, its rigorous formal outset that allows for clear, testable predictions, and, on the other, that it provides a unified account of implicatures due to the first sub-maxim of Quantity.

Apart from these points, this paper contributes in two other respects to the research on conversational implicatures. First, in section 4 we have seen that *eps*₂ generalizes Groenendijk & Stokhof’s (1984) description of exhaustive interpretation, which was already a very promising approach to a wide class of implicatures. Thereby it links their proposal to Grice’s theory of conversational implicatures and gives this more descriptive approach a conceptual, explanatory foundation. Second, the proposed formalization represents a strong argument against defenders of a local approach to conversational implicatures as Landman (2000) and Chierchia (ms). For a wide range of examples it falsifies their claim that global approaches cannot account for the implicatures of complex sentences.

The “Preferred” Readings of Donkey Sentences as Resolutions of the Underspecified Meanings

In this work, we will propose a novel analysis of the so-called “preferred” readings of donkey sentences. Our thesis is that the compositional, or conventional meaning of a donkey sentence is underspecified with respect to the quantificational force associated with the donkey pronoun, and the “preferred” readings are the results of the interpreter’s resolution of the underspecification by means of an inference strategy based on the logical property of persistence.

Let us review the phenomenon in question briefly. It has been observed that there are at least two types of readings for donkey sentences with respect to what quantificational force is associated with donkey pronoun; they are called “existential reading” and “universal reading”, in which the donkey pronoun is associated with existential quantificational force and universal one, respectively. Furthermore, the distribution of the readings is not random, but somewhat systematic. For instance, examples (1a)-(1d) are said to have the reading in the following parentheses as the “preferred” one, except for (1b), in which it is not clear about what quantificational force is associated with *it*.

- (1) a. Every farmer who owns a donkey beats it. (universal)
- b. Most farmers who own a donkey beat it.
- c. Some farmer who owns a donkey beats it. (existential)
- d. No farmer who owns a donkey beats it. (existential)

The widely accepted generalizations about the distribution of the readings are, as reported in e.g. Rooth (1987), Kanazawa (1994), and Geurts (2002), as follows:

- (2) a. Donkey sentences with weak determiners, e.g. *some* and *no* have only existential readings.
- b. Donkey sentences with universal determiners prefer universal readings, but may have existential readings.
- c. Donkey sentences with *most* do not have any preferences for either existential or universal readings.

In the following, we will present a novel analysis of the “preferred” readings of donkey sentences described in (2). As evidenced by data-based studies such as Yoon (1996) and Geurts (2002), the quantificational force associated with a donkey pronoun is not categorical in nature in contrast with that for the determiner quantifier. We take the non-categoricity to indicate that the quantificational force for a donkey pronoun is not hard wired as that for the head determiner; in other words, the compositional meaning of a donkey sentence is underspecified with respect to the quantificational force of the donkey pronoun. The question here is how one determines, or resolves the quantificational force associated with the donkey pronoun. We propose that interpreters use the following resolution strategy. When the truth conditions are not determinate, they will see if there are any determinate false conditions available. (After all, the interpreters are asked to judge if a given donkey sentence is true or false in a given context.) If there are, they will take the complement of the false conditions to be the “inferred” truth conditions. The next question is what is the property characterizing the false conditions as determinate when the truth conditions are indeterminate being underspecified. We propose that the property in question is PERSISTENCE. To see what we mean by that, first we need to introduce a couple of definitions.

(3) Definition (Extension relation between models)

For any two models M and N , N is an extension of M ($M \leq N$) iff $D_M \subseteq D_N$ and $\|R\|_M \subseteq \|R\|_N$ for all basic predicates R , where D_M is the domain of discourse for a model M .

(4) Definition (Persistence, T-Persistence, and F-Persistence)

A sentence, or its logical formula ϕ is t-persistent (f-persistent) iff $M \leq N$ and ϕ is

true (false) in M together imply ϕ is true (false) in N. A sentence, or its logical formula ϕ is persistent iff it is both t- and f-persistent.

In general, quantified sentences are not persistent (both t- and f-persistent); they are t-persistent, f-persistent, or neither t-persistent nor f-persistent. For illustration, let us show the persistence properties of some quantified sentences involving quantifiers relevant to the present discussion in (5), where on each row from left to right is a schematic logical form in the style of Heim (1982), its persistent property, which is followed by the verifying (truth) or falsifying (false) conditions if the logical form is t- or f-persistent, respectively, and $\exists$ is an unselective existential quantifier in the sense of Lewis (1975).

(5)	EVERY(ϕ, ψ)	f-persistent	$\exists(\phi, \neg\psi)$
	MOST(ϕ, ψ)	neither t-per. nor f-per.	
	SOME(ϕ, ψ)	t-persistent	$\exists\phi, \psi$
	NO(ϕ, ψ)	f-persistent	$\exists\phi, \psi$

With the persistence properties shown in (5), we will propose that people adopt the following inference as a strategy to resolve the underspecified meaning of a donkey sentence:

- (6) If a given donkey sentence is t-persistent, the verifying conditions are the “default” reading. If a donkey sentence is f-persistent, the complement of the falsifying conditions is the “default” reading. Otherwise, i.e. if a donkey sentence is neither t-persistent nor f-persistent, there is no candidate for “default” reading.

As an illustration that the readings inferred by means of the strategy in (6) nicely conform to the generalizations in (2), we will show the persistent verifying or falsifying conditions and the “inferred” readings for (1a)-(1d) when applicable in (7).

- (7) (1a) $\exists_{x,y}(\text{farmer}(x) \wedge \text{donkey}(y) \wedge \text{own}(x, y), \neg\text{beat}(x, y))$ (persistent falsifying conditions)
 $\text{EVERY}_x([F(x) \wedge \exists_y(D(y) \wedge O(x, y))], \forall y[(D(y) \wedge O(x, y)) \rightarrow B(x, y)])$ (the complement of the above) (universal reading)
- (1b) not applicable
 not applicable (neither universal nor existential reading)
- (1c) $\exists_{x,y}(\text{farmer}(x) \wedge \text{donkey}(y) \wedge \text{own}(x, y), \text{beat}(x, y))$ (persistent verifying conditions)
 $\text{SOME}_x(F(x) \wedge \exists_y(D(y) \wedge O(x, y)), \exists_y(D(y) \wedge O(x, y) \wedge B(x, y)))$ (the same as above) (existential reading)
- (1d) $\exists_{x,y}(\text{farmer}(x) \wedge \text{donkey}(y) \wedge \text{own}(x, y), \text{beat}(x, y))$ (persistent falsifying conditions)
 $\text{NO}_x(F(x) \wedge \exists_y(D(y) \wedge O(x, y)), \exists_y(D(y) \wedge O(x, y) \wedge B(x, y)))$ (the complement of the above) (existential reading)

We have seen that the above persistence-based inference strategy can nicely account for the “preferred” readings of donkey sentences as described in (2). In the talk and the paper, we will demonstrate that the current analysis is empirically more adequate than the existent analyses, specifically Kanazawa’s (1994) primarily semantic analysis based on the monotonicity properties of head-determiner quantifiers and a group of underspecification-based analyses of the brand referred to by Kanazawa (2001) as the *Number Neutrality Thesis*, such as Lappin and Francez (1994), Yoon (1996), and Krifka (1996).

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