On the Characterization of Alternatives[*]

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1   Introduction

The computation of both Scalar Implicature (SI) and Association with Focus (AF) is generally assumed to make reference to sets of alternatives, and in both cases the alternatives are constrained by grammar, which determines a set of formal alternatives, and by context, which selects a subset of the formal alternatives. Moreover, as noted by Rooth (1992), the placement of focus can affect both processes. Beyond these similarities, however, the alternatives are often assumed to be quite different. For SI, the formal alternatives are taken to be determined by the special mechanism of Horn Scales (Horn, 1972), in which linguistic elements are related to alternatives through a family of lexical stipulations. For AF, the formal alternatives are taken to be determined by the general theory of focus semantics (Rooth, 1985), in which every linguistic element has as its alternatives all other elements of the same semantic type.

The goal of this paper is to argue that the alternatives for SI and AF are in fact the same.[1] While the generality of focus semantics and the sensitivity of SI to focus placement may suggest using focus alternatives as a basis for both, we will show that in one crucial respect the standard theory of SI fares better than that of AF. The advantage of the standard theory of SI concerns its ability to address a challenge known in the literature on SI as the *symmetry problem*. Symmetry arises when a linguistic expression S is equivalent to the disjunction of two of its alternatives S_1 and S_2, which in turn contradict each other. In such a case, we will call S_1 and S_2 *symmetric* alternatives of S. As has been noted in the literature, if S_1 and S_2 are symmetric alternatives of S, neither $\neg S_1$ nor $\neg S_2$ is a possible SI of S. This means that when $\neg S_1$ is an SI of S, S_2 must be prevented from being an alternative, and that when $\neg S_2$ is an SI of S, S_1 must be prevented from being an alternative. We will refer to the elimination of one out of two symmetric alternatives as *symmetry breaking*. The symmetry problem is the problem of ensuring that symmetry is broken in a way that matches the empirical pattern of SIs.

[1]To our knowledge, the only other attempt to provide a unified account of SI and AF is Krifka (1995), who bases his account on the stipulation that scalar items are inherently focused and have their Horn Scales as alternatives.

As a simple example, consider S = *John did some of the homework* and its symmetric potential alternatives S_1 = *John did all of the homework* and S_2 = *John did some but not all of the homework*. In this example, S has the SI $\neg S_1$, a result that is only possible if S_2 is not an actual alternative to S. The standard theory of SI ensures this result by formally restricting the alternatives of S to the result of replacing certain elements in S with members of their Horn Scales and by making the appropriate stipulations regarding what items are on the same Horn Scale. In our example, *all* is a scale-mate of *some*, licensing S_1 as a formal alternative to S; on the other hand, *some but not all* is not a scale-mate of *some*, so S_2 is not a formal alternative to S. More generally, the main role of Horn Scales can be seen as addressing the symmetry problem by stipulating scales that break symmetry in the right direction. Importantly, Horn Scales break symmetry formally, in the grammar.

Our first observation, discussed in section 2, will be that the same problem of symmetry arises also for AF. For AF, however, Rooth's theory of focus semantics prevents the breaking of symmetry in the grammar. This means that the theory of AF must rely on contextual restriction for symmetry breaking. As we will argue, this is an undesirable outcome.

We are left with a dilemma: focus semantics is more general and offers a better handle on the focus-sensitivity of SI than Horn Scales; on the other hand, Horn Scales allow symmetry breaking by the grammar, while focus semantics does not. We will resolve this dilemma in section 3 by adopting the structural approach to alternatives argued for in Katzir (2007), where alternatives are determined by a general definition in terms of structural complexity. We modify that approach so as to localize alternatives to focused constituents. The result is a general procedure that allows for focus sensitivity and for symmetry breaking by the grammar. We suggest that this procedure determines the formal alternatives both for SI and for AF.[2]

Section 4 provides evidence that symmetry can only be broken in the grammar, further supporting our proposed definition of alternatives and strengthening our claim from section 2. We start with a structure S for which, of two symmetric potential alternatives S_1 and S_2, the latter is systematically absent. For a type-based account such as Rooth's, this would be due to context, while for a structural approach like our own this is due to grammar. We then modify S so as to bring S_2 into the set of formal alternatives according to the proposal that we develop in section 3. This ensures that the formal alternatives of S include the symmetric S_1 and S_2, not only according to Rooth's theory but also according to our proposal. Furthermore, we use a symmetry diagnostic suggested recently in the literature to show that both S_1 and S_2 are indeed formal alternatives. Finally, we ensure that S_2 is salient and that S_1 is not. For a type-based approach, where context must be allowed to break symmetry, such a configuration should allow the context to keep S_2 and eliminate S_1. A structural approach, on the other hand, is not committed to this result, as we will see. We provide evidence that the prediction of the type-based approach is incorrect in this case.

The discussion in section 4 shows that context is incapable of breaking symmetry: if there are symmetric alternatives before contextual pruning applies, pruning the one

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[2]The fact that focus semantics is central to SI will lend support to theories of SI that are based on focus sensitivity (Krifka, 1995, Fox, 2007a, Chierchia, 2006, and Chierchia, Fox, and Spector, 2008).

will be impossible without pruning the other as well. In section 5 we discuss ways in which this property of contextual restriction can be derived. In particular, we will show that it follows from the idea that contextual restriction involves selecting a set of relevant alternatives from a formally defined set, given certain assumptions about relevance.

Before proceeding to our main argument, we will use the remainder of this introduction to review common assumptions about the division of labor between grammar and context in deriving the alternatives for SI and AF.

1.1 Scalar Implicature

Following are some simple sentences with their SIs:[3]

(1) John did some of the homework
     SI: ¬ [John did all of the homework]

(2) John did the reading or the homework
     SI: ¬ [John did the reading and the homework]

(3) John has three children
     SI: ¬ [John has four children]

The SI of S given a set A of alternatives involves the negation of elements in a subset of A, $N_{SI}(A, S)$:[4]

(4) $SI_A(S) = \bigwedge\{\neg S_i : S_i \in N_{SI}(A, S)\}$

We can now define the strengthened meaning of S given a set A of alternatives to be the conjunction of S with its SI:

(5) $SM_A(S) = S \wedge SI_A(S)$

Our focus in what follows will be the question of how A is determined. Since Horn (1972), the standard answer to this question has been that A is a contextually determined subset of a set $F(S)$ of formal (grammatical) alternatives. Assuming for the moment that the contribution of context can be defined independently of F, we can define A as the intersection of the two sets, F and C, where C is a set of contextually determined sentences:[5]

(6) $A = C \cap F(S)$

C is invoked since, as already observed by Horn (1972, p. 112), different SIs are generated in different contexts. For example, (7), repeated from (1) above, has (8a) and (8b) as optional strengthened meanings.

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[3]The brackets in examples (1) to (3) are included to mark the scope of negation. To enhance readability, we will omit the brackets in subsequent examples, but the scope of negation will still be maximal.

[4]A question that we will mostly ignore in what follows concerns the definition of $N_{SI}(A, S)$, the elements in A that are negated. It has often been assumed, as in much of the literature following Grice (1989), that the members of $N_{SI}(A, S)$ are all strictly stronger than S, but see van Rooij and Schulz (2004), Spector (2006), Fox (2007a), Chierchia, Fox, and Spector (2008), and Chemla (2009), among others, for arguments that $N_{SI}(A, S)$ should also include elements that do not stand in an entailment relation with S.

[5]We will revisit the question of whether contextual restriction can be stated independently of F in section 5.2 below.

(7) John did some of the homework

(8) Optional strengthened meanings for (7):

    a. (7) and ¬ John did most of the homework

    b. (7) and ¬ John did all of the homework

The idea that (6) can yield the desired optionality depends on an unanalyzed notion of contextual restriction. However, it seems reasonable to assume that no harm could come from whatever we might learn about this notion, one which is clearly needed for the analysis of quantificational domain restriction (see Westerstahl, 1984 and von Fintel, 1994).

Restricting the alternatives using the formally defined $F(S)$ is done in order to avoid a problem noted by Kroch (1972), and discussed further in classnotes by Kai von Fintel and Irene Heim, who labeled it the *symmetry problem* (see also Horn, 2000 and von Fintel and Fox, 2002). The symmetry problem is this: for any sentence S for which we would like to use an alternative S_1 to derive an SI $\neg S_1$, there is always another potential alternative, $S_2 = S \& \neg S_1$, which, if taken into account, would prevent the desired SI from arising. For example, consider (3) above, repeated here as (9), along with two of its potential alternatives, listed in (10).

(9) John read three books
    SI: ¬ John read four books

(10) Potential alternatives:

    a. John read four books

    b. John read exactly three books

To derive the SI of (9), we must be able to negate (10a) but not (10b). On standard assumptions, this is accomplished by including the former but not the latter in the set $F(S)$ of formal alternatives. Following Horn (1972), $F(S)$ is usually defined as the set obtained from S by replacing certain items, *scalar items*, with members of a set of stipulated alternatives, often referred to as *Horn Scales*.

(11) $F(S) = \{S' : S'$ *is the result of replacing scalar items in S with their scale mates*$\}$

For example, *some* and *all* are scale mates, so occurrences of one can be replaced with those of the other. Similarly, *or* and *and* are scale mates, as are *three* and *four*, licensing the relevant substitutions. By stipulating the appropriate scales, we can account for the breaking of symmetry in (9): *three* and *four* are scale-mates, so (10a)$\in F(9)$; *three* and *exactly three* are not, so (10b)$\notin F(9)$. For our purposes, the significant point is that symmetry-breaking is assumed to take place in F. Using the notion of symmetry in (12) we can state this assumption as in (13).

(12) Let S, S_1, S_2 be three sentences. We will say that S_1 and S_2 are *symmetric* alternatives of S if both

    a. $[\![S_1]\!] \cup [\![S_2]\!] = [\![S]\!]$, and

    b. $[\![S_2]\!] \cap [\![S_2]\!] = \emptyset$

(13) Standard assumption: Symmetry for SI is broken by F

In section 2 we will try to show that (13) is indeed correct. Moreover, we will argue that F can break symmetry not only for SI but also for AF. In section 4 we will present evidence that F is the only place in which symmetry can be broken, and in particular that contextual restriction cannot eliminate one symmetric alternative without also eliminating the other.

1.2 Focus Semantics

Following are some simple sentences and entailments that they have due to AF:

(14) John only introduced Mary_F to Sue
      Inference: $\neg$ John introduced Jane to Sue

(15) John only introduced Mary to Sue_F
      Inference: $\neg$ John introduced Mary to Jane

(16) John only has three_F children
      Inference: $\neg$ John has four children

A sentence of the form $Only(S)$ has entailments that are similar to the SIs of S when uttered in isolation. In particular, it entails the negation of various alternatives A to the prejacent S. To make the parallel with SI more obvious, we will start by defining $EXC_A(S)$, the result of negating members of a subset of A, $N_{AF}(A, S)$:[6]

(17) $EXC_A(S) = \bigwedge\{\neg S_i : S_i \in N_{AF}(A, S)\}$

We can now define $Only(S)$ in analogy with the definition of strengthened meanings in (5) above:[7]

(18) $Only_A(S) = S \wedge EXC_A(S)$

As with SI, our concern will again be the question of how A is determined.[8] Here, too, the answer in the literature has been that A is a contextually determined subset of the set $F(S)$ of formal alternatives. Assuming again that the contribution of context can be defined independently of F, as a set C of contextually determined sentences, we can write A as the intersection of the two sets:

(19) $A = C \cap F(S)$

C is invoked since, as noted by Rooth (1985, pp. 42–3), different entailments are generated in different contexts. The sentence in (20), uttered in response to the question *What did Mary do yesterday?*, can be taken to mean either (21a) or (21b), among other possibilities, depending on context:

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[6]We treat AF as applying at the propositional level, rather than at the level of properties as in Rooth's account. This is done for expository convenience only (specifically, in order to make the similarity with SI more obvious).

[7]We gloss over important questions of the division of labor between assertion and presupposition in the semantics of *only*.

[8]As for the question of which elements in A are negated, the standard view is that $N_{AF}(A, S)$ is composed of sentences in A that are *non-weaker* than S.

(20) Mary only [read War and Peace]$_F$

(21) a. (20) and ¬ Mary saw a movie

   b. (20) and ¬ Mary ate an apple

Restricting the alternatives using the formally defined $F(S)$ is done in order to account for focus sensitivity. For example, (14) and (15) above are identical other than the placement of focus, and so their different entailments cannot be attributed to context alone. The definition of $F(S)$ in this case is taken to follow from Rooth (1985)'s general, non-stipulative definition in terms of semantic types: each focused constituent contributes as alternatives all the possible denotations of the same type.

(22) $F(S) = \{S' : S'$ *is the result of replacing focused items in S with elements of the same semantic type*$\}$

As noted by Rooth (1992), the focus sensitivity of F in AF suggests an interesting connection with SI. Rooth observes that the placement of focus affects the possible inferences that an utterance gives rise to, even in the absence of an overt focus-sensitive operator:

(23) How did the exam go?

   a. Well, I [passed]$_F$

   b. Well, [I]$_F$ passed

The two answers in (23), differing only in the placement of focus, license different inferences. (23a), with focus on the *VP*, suggests that the speaker only passed, rather than aced the exam; it suggests nothing about whether other people passed or not. (23b), with focus on the subject, suggests that some other people did not pass, without implying anything about whether the speaker did better than just pass. In each case, the alternative that is used to compute the implicature is obtained from the utterance by a substitution *within the focus-marked phrase*.

Another example that makes the same point is the following. In (24), with focus on the *VP*, the speaker implies that they do not believe that John talked to both Mary and Sue yesterday. This is the familiar SI for disjunction. The SI disappears, or is at least weakened, in sentences like (25) where the *VP* is not focused.[9]

(24) a. What did John do yesterday?

   b. He [talked to Mary or Sue]$_F$

(25) a. Who talked to Mary or Sue yesterday?

   b. [John]$_F$ talked to Mary or Sue yesterday

Rooth suggests that this is true more generally, and that the alternatives for scalar implicature are derived from the assertion by substitutions that are confined to focused phrases.[10]

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[9]We suspect that the fact that SIs are not always impossible outside the main focus is related to second-occurrence focus in those cases. We do not pursue this matter further here.

[10]See Kadmon (2001, pp. 323–326), Sevi (2005), and Zondervan (2009), among others, for further discussion.

1.3 A comparison

SI and AF (in the case of *only*) both involve conjoining a sentence S with the negations of its negatable alternatives $N(A, S)$, where A is determined both by contextual factors, C, and by a formal restriction, $F(S)$. The main difference between the standard view of SI and of AF is the following:[11]

(26) Difference between the standard view of SI and of AF: for SI, $F(S)$ is determined by stipulated lexical properties, namely *Horn Scales*. For AF, $F(S)$ is determined by Rooth's general procedure of focus alternatives, based on semantic type.

As mentioned earlier, we will argue against this view. Instead, we will provide evidence that the set of formal alternatives $F(S)$ (as well as C, and hence also the set of actual alternatives A) is determined in the same way for both SI and AF:

(27) Claim: $F_{SI}(S) = F_{AF}(S)$

Of course, (27) can only be true if we revise the definition of formal alternatives for either SI or AF. In fact, we will argue that we need to revise the definition for both. The generality of focus semantics and the sensitivity of SI to focus placement, which we discussed in section 1.2, suggest properties of focus semantics that we may want to incorporate into the theory of SI. On the other hand, we will see in section 2 that grammar should be allowed to break symmetry, suggesting a property of the theory of SI that we will want to incorporate into focus semantics. Section 3 presents our proposal of a unified theory of alternatives for SI and AF that combines the generality and focus-sensitivity of focus semantics with the ability of Horn Scales to break symmetry. Section 4 strengthens our claim from section 2, providing evidence that symmetry breaking can only take place in grammar: if $S_1, S_2 \in F(S)$ are symmetric alternatives of S, then S will never have $\neg S_1$ as an SI and $Only(S)$ will never entail $\neg S_1$. In particular, this means that context never breaks symmetry:[12]

(28) Condition on contextual restriction: symmetry cannot be broken in C

Section 5 considers two ideas about how the constraint in (28) is derived. If the direction we suggest in that section is correct, contextual restriction amounts to selecting a set of relevant alternatives from F, where relevance is subject to certain closure conditions.

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[11] As mentioned in footnotes 4 and 8 above, another potential difference concerns the definition of $N(A, S)$: for SI, the negated alternatives are often assumed to be those that are *stronger* than S, while for AF, the negated alternatives are taken to be the larger set of *non-weaker* alternatives. This difference, which, as mentioned above, has been challenged in the literature, will not directly affect our discussion.

[12] We have deliberately ignored $N(A, S)$ in our discussion. As argued by Fox (2007a) (building on an argument by Sauerland, 2004b), $N(A, S)$ is subject to a condition that prevents it from choosing arbitrarily between alternatives when those cannot be negated consistently with S. As a special case, $N(A, S)$ cannot break symmetry, so if there is no symmetry in $N(A, S)$, there was no symmetry in A to begin with. Consequently, once we have shown that C cannot break symmetry, we will be able to conclude that symmetry-breaking is restricted to F.

2 In support of a formal theory of symmetry breaking

We discussed the symmetry problem for SI and its familiar resolution by means of Horn Scales. For AF, symmetry has not been discussed in the literature, perhaps because in simple cases like (14) and (15) above, focus falls on a constituent of type e, so symmetry does not arise. We observe that once we move to constituents of types that end in t, such as the VPs in (29) and (31), the same symmetry problem we discussed for SI arises for AF:

(29) (Context: what did John do?)
John only [read three books]$_F$
Inference: ¬ John read four books

(30) Potential alternatives:

    a. S_1: John read four books

    b. S_2: John read exactly three books

(31) (Context: what did John do?)
John only [read War and Peace]$_F$
Inference: ¬ John saw a movie

(32) Potential alternatives:

    a. S_1: John read War and Peace and saw a movie

    b. S_2: John read War and Peace and didn't see a movie

Both in (29)/(30) and in (31)/(32), S_1 and S_2 contradict each other and their disjunction is equivalent to the prejacent. In other words, S_1 and S_2 are symmetric alternatives of the prejacent. The inferences from (29) and from (31) require negating S_1 and not negating S_2. Here, however, Rooth's definition of focus values in terms of semantic type precludes the breaking of symmetry in F: *[$_{VP}$read four books]* and *[$_{VP}$read exactly three books]* are of the same semantic type, as are *[$_{VP}$ read War and Peace and saw a movie]* and *[$_{VP}$ read War and Peace and didn't see a movie]*. This means that if S_1 is a formal alternative to the prejacent, so is S_2. On these assumptions, then, symmetry in AF must be broken in C.

We can already see that there is an important ingredient that is missing from a theory such as Rooth's. Such a theory must allow context to prune one symmetric alternative while keeping the other, and as (29) and (31) show, this symmetry breaking is systematically in one direction: even though nothing in the surrounding context helps us choose, when symmetry is broken in (29) and in (31), it is always S_2 that is pruned and S_1 that is kept.[13] Since the direction appears to be arbitrary from the perspective of context, it seems natural to make the choice in grammar. The standard approach to SI recognizes this and builds symmetry breaking into the mechanism of Horn Scales.

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[13]Note, for example, that both in (29) and in (31), the hearer may respond by challenging ¬S_1, presumably because it is an inference of the assertion, but challenging ¬S_2 is odd, presumably because it is not an inference (see Kratzer, 1989). Thus, *No, he read four books* is a possible response to (29), but *# No, he read exactly three books* is not; similarly, *No, he also saw a movie* is a possible response to (31), but *# No, he also didn't see a movie* is not.

Rooth's type-based approach to focus semantics, on the other hand, is committed to symmetric formal alternatives.[14]

The problem for the type-based approach, as far as we can see, extends to all cases in which expressions that are of a type ending in t are focused. For instance, we could have used quantifiers, of type $< et, < et, t >>$, in our presentation, instead of VPs. Our discussion could then revolve around an example like *John only read [some]$_F$ of the books* and its symmetric potential alternatives *John read all of the books* and *John read some but not all of the books*.[15]

Could the type-based approach maintain its use of symmetric formal alternatives by assuming that usual contexts just happen not to have S_2 as a member? Regardless of whether such an assumption can be motivated, we do not think that it would help. If the perceived systematic direction of symmetry breaking were the result of an accidental property of contexts, we might expect that modifying (29) so as to make *read exactly three books* salient would allow context to prune S_1 while keeping S_2. The following modification of (29) suggests that this is not possible:

(33)   (Context: Mary read exactly three books. What did John do?)
        John only [read three books]$_F$
        *Inference: ¬ John read exactly three books

In (33) we have modified the context so as to make the VP *read exactly three books* salient (and without mentioning *read four books*). If both of the potential alternatives in (30) were indeed among the formal alternatives, and if context could choose from them, we would expect (33) to allow the selection of S_2 and the pruning of S_1. This, in turn, would amount to (33) having the entailment $\neg S_2$, which it clearly does not have: whatever else (33) might mean, it does not say that John read four (or more) books.

We can conclude that for AF, symmetry is at least sometimes broken systematically in the definition of formal alternatives. In other words, the same problem and the same reasoning that we saw for SI apply also for AF, and we should look for a way to replace Rooth's definition of formal alternatives with one that breaks symmetry. Section 3 provides such a definition, which we will propose both for SI and for AF. In section 4 we will strengthen our argument from the current section by providing evidence that F is responsible for all instances of symmetry breaking: once we introduce symmetry into F, it cannot be broken anywhere else. In particular, context will never be able to break symmetry. In section 5 we will suggest that the inability of context to break symmetry follows if we think of contextual restriction as the selection of a set of relevant, rather than salient, alternatives from F.

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[14]To simplify our discussion and to keep the analogy to (29) clearer, we purposely chose to discuss (31) in the context of its symmetric alternatives in (32). We note that the problem for Rooth with systematic choices between potential alternatives would arise also with the non-symmetric and more obvious alternatives *John saw a movie* and *John didn't see a movie*. The complexity-based account that we will present in section 3 will prevent both *John didn't see a movie* and the potential alternatives in (32) from being formal alternatives to (31), leaving only *John saw a movie* as a formal alternative. Moreover, our derivation in section 5.1 of the constraint on contextual restriction will also apply to non-symmetric alternatives like *John saw a movie* and *John didn't see a movie*, preventing the contextual elimination of one without the elimination of the other (when both are formal alternatives).

[15]The special case of QPs, of type $< et, t >$, has been discussed by Groenendijk and Stokhof (1984), with refinements in Sevi (2005), but we do not see how this can extend to other types ending in t.

3 A new theory of alternatives

In the previous section we arrived at a requirement that, both for SI and for AF, symmetry is sometimes broken in F. We further noted that Horn (1972)'s theory of scalar alternatives allows for some symmetry-breaking in F, while Rooth (1985)'s theory of focus alternatives does not. On the other hand, the type-based mechanism for F in AF is fully general, while the scale-based mechanism for F in SI is stipulative. In this section we will present a structural definition for F in both SI and AF that preserves the generality of the theory for AF while allowing F to break symmetry.

As in the theories of Horn and Rooth, we will define the alternatives in terms of replaceable elements and their possible replacements. In order to account for focus sensitivity both in SI and in AF, we will follow Rooth in identifying the replaceable elements with the set of focused constituents. The possible replacements, however, will have to be able to break symmetry, which Rooth's alternatives cannot. Instead, we will follow the proposal in Katzir (2007) – originally stated for SI only but extended here also to AF – in identifying the possible replacements of a constituent with the set of all constituents that are at most equally complex, under a particular definition of complexity.

The definition of F in Katzir (2007) makes use of a notion of structural complexity in a given context. Simplifying somewhat, we can define a relation between structures $\precsim_C$, 'at most as complex as in context C', as follows:

(34) $S' \precsim_C S$ if S' can be derived from S by successive replacements of sub-constituents of S with elements of the substitution source for S in C, $SS(S, C)$

(35) $SS(X, C)$, the substitution source for X in context C, is the union of the following sets:

   a. The lexicon
   b. The sub-constituents of X
   c. The set of salient constituents in C[16]

Simplifying a structure X using substitutions from the lexicon and from the set of sub-constituents of X is generally straightforward. The use of salient constituents, as allowed by (35c), is less obvious. Evidence in support of this clause comes from examples such as the following, from Matsumoto (1995):

(36) It was warm yesterday, and it is a little bit more than warm today
      SI: ¬ It was a little bit more than warm yesterday

As Matsumoto notes, (36) suggests that yesterday it was not a little bit more than warm. To derive this SI, we need access to an alternative in which *warm* in the first conjunct has been replaced with the intuitively more complex *a little bit more than warm*. Accommodating this within a complexity-based approach can be done by allowing the use of salient constituents in surrounding discourse as part of the substitution source, as in

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[16]As we will note in fn. 23 below, SIs based on salient constituents are optional. To account for this, the statement of (35c) can be modified to allow different sets of salient constituents to be associated with a single sentence in a particular context. This, in turn, would turn the substitution source into a family of possible substitution sources, of which one is chosen.

(35c). See Katzir (2007) for further discussion. In section 4 we will use modifications of (36) to introduce symmetry into F.

Using these definitions, we can now provide a focus-sensitive version of Katzir's proposal and define F to be the set of all structures obtained from S by replacing focused constituents within S with constituents that are at most as complex as the original constituents.[17]

(37) $F(S,C) = \{S' : S'$ is derived from S by replacing focused constituents $x_1, \ldots, x_n$ with $y_1, \ldots, y_n$, where $y_1 \lesssim_C x_1, \ldots, y_n \lesssim_C x_n\}$

The definition in (37) is a structural variant of Rooth's definition, maintaining the generality of Rooth's type-based proposal. At the same time, it makes it possible for F to break symmetry, which the type-based proposal did not do. For example, while *some*, *all*, and *some but not all* are all of type $< et, < et, t >>$, only *some* and *all* are of the same complexity, and *some but not all* is strictly more complex (as long as context does not add *some but not all* to the substitution source, as allowed by (35c), making *some but not all* equally complex). This means that by the type-based definition, an occurrence of *some* will bring in *all* and *some but not all* as replacements, giving rise to symmetry. The structural definition, on the other hand, will only bring in *all* (again, unless context adds to the substitution source in a way that changes this).

4 C does not break symmetry

In section 2 we tried to show that F is sometimes inherently asymmetric: the systematic way in which inferences follow both in SI and in AF requires choices that are more plausibly in the domain of grammatical processes than in that of contextual ones. In section 3 we used this observation for our proposal of a unified theory of alternatives for SI and AF. In the current section we will provide further evidence for our proposed alternatives. We will also strengthen our claim about symmetry breaking: it is not just that F sometimes breaks symmetry, it is the only place where this can happen. In particular, as we stated in (28) above, C can never break symmetry. Our evidence comes from cases where we have an independent way of telling that S has two symmetric alternatives, S_1 and S_2, in F. We will argue that whenever this happens, neither $\neg S_1$ nor $\neg S_2$ can be an SI of S or an entailment of $Only(S)$.

4.1   Breaking symmetry in SI

Consider the following disjunction:[18]

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[17]As discussed in Katzir (2008, pp. 71–73), $F(S,C)$ can also be defined recursively, in parallel with Rooth (1985)'s definition. Such a definition provides a compositional derivation for $F(S,C)$.

[18]The reason we have chosen the particular disjunction in (38) is that it has symmetric alternatives, as we will shortly see. Other instances of disjunction often have disjuncts that are mutually compatible (that is, their intersection is not empty), and so by our definition they do not constitute symmetric alternatives. For our purposes, it is enough to consider symmetric alternatives, and to show that contextual pruning cannot distinguish among them. It is possible that the constraint on contextual pruning will need to be strengthened to rule out pruning in certain cases that do not involve symmetry. We will return to this issue in section 5.

(38) John did all of the homework or none of the homework
    *SI: ¬ John did all of the homework
    *SI: ¬ John did none of the homework

As argued by Sauerland (2004b), (38) has the following two alternatives (among others):

(39) a. John did all of the homework

    b. John did none of the homework

Evidence that both disjuncts are indeed alternatives to (38) comes, among other considerations, from the embedding of (38) under a universal operator (see Sauerland, 2004a; Spector, 2006; Fox, 2007a):[19]

(40) John is determined to do all of the homework or none of the homework
    SI: ¬ John is determined to do all of the homework
    SI: ¬ John is determined to do none of the homework

(41) Each of my students did all of the homework or none of the homework
    SI: ¬ Each of my students did all of the homework
    SI: ¬ Each of my students did none of the homework

In (40) and (41), the universal operator guarantees that the alternatives obtained by taking a single disjunct will not be symmetric. In the original (38), on the other hand, symmetry holds. If C could eliminate one of the alternatives in (39) while keeping the other, we would expect to find the negation of the remaining alternative as an SI. Crucially, however, (38) cannot have the negation of either of the alternatives in (39) as an SI. In this case, then, our claim in (28) seems to hold: C cannot break symmetry for (38).[20]

What we just saw could look like an argument against symmetry-breaking in C. However, (38) involves an obvious confound. Each of the alternatives in (39) is already present in some sense in the asserted (38). A competing account, then, could appeal to a principle that prevents an expression that is explicitly mentioned in previous discourse from being removed from C. After all, C is sometimes viewed as the set of *salient* sentences. In view of this competing account, what we need is a sentence that has symmetric formal alternatives, at least one of which is not made salient by previous discourse.

We can construct the relevant examples as follows. We start with a sentence S that can have the SI $\neg S_1$ and that never has S_1 as an SI, suggesting, based on our earlier

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[19]Sauerland's motivation for having both disjuncts as alternatives in the general case of disjunction comes, among other considerations, from the implications of embedded scalar items within disjuncts (cf. Chierchia, 2004).

[20]Our interest here is in the ability of context to break symmetry for SI (and below for AF). We are not concerned with the possibility that the context already entails that one of the alternatives is false. For example, in a context that entails that John always does at least some of the homework, (38) entails that he did all of it. Note also that using (38) in such a context is usually odd (see Magri, 2009 and Singh, 2010 for discussion). We will also ignore the question of whether in cases like (40) and (41), where symmetry does not arise, contextual restriction can eliminate one or the other of the alternatives. We are not sure what the facts are in such cases, and as far as we can see, our arguments do not depend on this point.

discussion, that $S_1 \in F$ and that $S_2 = S \wedge \neg S_1 \notin F$. By mentioning S_2 in surrounding discourse we will both add S_2 to F, according to (35c), and make S_2 salient.[21] We will then be able to check whether $\neg S_2$ can be an SI, as a theory that allows symmetry breaking by C predicts, or not. The following sentences have been constructed in this way:[22]

(42)   a. John did some of the homework yesterday, and he did just some of the homework today

        b. John did just some of the homework today, and he did some of the homework yesterday

     *SI: ¬ John did just some of the homework yesterday

If our construction is correct, F for the sentences in (42) will have two symmetric alternatives, one in which *some of the homework* has been replaced with *all of the homework* and one in which it has been replaced with *just some of the homework*. (42a), for example, would have both of the following as alternatives:[23]

(43)   a. John did just some of the homework yesterday . . .

        b. John did all of the homework yesterday . . .

Symmetry in F in this case would also be predicted by a type-based theory of alternatives such as an extension of Rooth (1985)'s theory to SI. The difference is that a type-based account would be committed to allowing context to break symmetry, while our account is not. Since the alternative with *just some of the homework* has been made salient in (42), a type-based account should allow context to keep it and eliminate the other alternative, the one with *all of the homework*. The result would be an SI that is the negation of the claim that John did just some of the homework yesterday, which together with the assertion that John did some of the homework yesterday would amount to the claim that yesterday John did all of the homework. This SI is clearly absent in (42), which we take as further evidence against a type-based approach. For our account, we take the absence of this SI as showing that F not only can break symmetry, but is the only place where this is possible: contextual restriction cannot break symmetry, so as soon as we bring symmetry into F, as we just did, an SI that is based on negating one of the alternatives will be impossible.

Before we conclude this section and proceed to a similar discussion of AF, let us convince ourselves that F for (42) is indeed symmetric. This will not affect our

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[21](35c) offers a general way of adding the symmetric S_2 to F without making S_1 salient, but as pointed out to us by an anonymous NALS reviewer, it would be interesting to look for other ways to do so. One direction that we would like to investigate in this context is the approach to formal contradictions in Abrusán (2007) and Fox (2007b). Another direction would be to look for particular lexical configurations, such as the potentially symmetric kinship terms discussed by Matsumoto (1995).

[22]The sentences in (42) are based on examples discussed by Katzir (2007) and modified, in turn, from examples like (36) above, due to Matsumoto (1995).

[23](43a) is brought into F by context according to (35c), possibly subject to certain discourse and prosodic conditions, while (43b) is always in F, due to (35a). See Katzir (2007) for further discussion. As pointed out to us by Micha Breakstone (p.c.), (42) can have the SI ¬(43b). We take this as evidence for the idea mentioned in fn. 16 above that alternatives like (43a), even when made salient, are not necessarily members of F.

argument against a type-based approach, presented in section 2, but it is important for our stronger claim that context can never break symmetry. As in the disjunctive examples above, embedding under a universal operator shows that both sentences in (43) are available as alternatives:

(44)   John was required to do some of the homework yesterday, and he was required to do just some of the homework today
SI: ¬ John was required to do just some of the homework yesterday
SI: ¬ John was required to do all of the homework yesterday

Sentence (44) gives rise to an inference that yesterday John was not required to do all of his homework, nor was he required to do some but not all of it. This is predicted by the idea that both *just some* and *all* can be alternatives to *some*: due to the presence of the universal modal *require*, the negations of the two stronger alternatives below, (45a) and (45b), are compatible with each other and with the assertion (that is, the universal modal ensures that there will be no symmetry).[24]

(45)   a. John was required to do just some of the homework ...

b. John was required to do all of the homework ...

Like the universal modal *require*, the universal quantifier *every* can also eliminate the symmetry of *some*, *just some*, and *all*:

(46)   Last week I gave an exam to the third graders, who are a highly motivated bunch, and I was very happy to learn that every single student (even the weakest of them all) got some of the questions right. Today I gave an exam to the fifth graders, who are all very talented. I was disappointed to learn that this time every single student got just some of the questions right.
SI: ¬ Last week, every student got just some of the questions right
SI: ¬ Last week, every student got all of the questions right

This is of course very similar to what we saw in the context of the disjunctive (38) above. As with (38), embedding under a universal shows that we are dealing with true symmetry in F.

Given that (38) and (42) involve true symmetry, a theory that disallows symmetry breaking in C correctly predicts the absence of an SI. The difference is that (38) left possible an alternative explanation for the absence of SIs, namely that explicitly mentioned material is obligatorily included in C. In (42), on the other hand, this alternative explanation would not help. This takes care of the confound, leaving us with an argument against symmetry-breaking in C.

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[24]Confirmation of these judgments comes from the contrast in felicity between the following discourses, suggested to us by Raj Singh (p.c.):

i. S: Yesterday, John was required to do some of the homework, and today he was required to do just some of it
H: No, I don't think so! John wasn't allowed to do all the homework yesterday!

ii. S: Yesterday, John was required to do some of the homework
H: # No, I don't think so! John wasn't allowed to do all the homework yesterday!

4.2 Breaking symmetry in AF

The pattern of symmetry and its elimination that we just saw for SIs repeats itself with AF. Consider the sentences with *only* in (47):

(47) a. In last week's robbery they only [stole the books]$_F$. In today's robbery they [stole the books but not the jewelry]$_F$

     b. In today's robbery they [stole the books but not the jewelry]$_F$. In last week's robbery they only [stole the books]$_F$

     *Inference: ¬ In last week's robbery they stole the books but not the jewelry

As in our discussion of SI in section 4.1 above, our structural definition of alternatives and Rooth (1985)'s type-based definition agree that the sentences with *only* in (47) involve symmetry, due to the presence of the following alternatives:

(48) a. In last week's robbery they stole the books but not the jewelry

     b. In last week's robbery they stole the books and the jewelry

On our account, the possibility of having in F an intuitively more complex alternative such as (48a) is licensed by (35c). For Rooth, both alternatives are in F because they result from replacing the original VP with another element of the same semantic type. The difference, again, is that the salience of the VP *stole the books but not the jewelry* should lead a type-based approach to expect that context should be able to keep (48a) and eliminate (48b), which would lead to the inference that in last week's robbery they stole the books and the jewelry. This inference is impossible for the examples in (47), strengthening our argument against a type-based approach. For our account, we take the absence of this inference as showing that symmetry can only be broken by F and never by contextual restriction.

As in our discussion of SI, we can use a universal operator to show that both alternatives are indeed in F:

(49) a. Detective A only concluded that the robbers [stole the books]$_F$. Detective B concluded that the robbers [stole the books but not the jewelry]$_F$

     b. Detective B concluded that the robbers [stole the books but not the jewelry]$_F$. Detective A only concluded that the robbers [stole the books]$_F$

     Inference: ¬ Detective A concluded that the robbers stole the books but not the jewelry

     Inference: ¬ Detective A concluded that the robbers stole the books and the jewelry

We conclude that in AF, too, symmetry can only be broken in F and never in C.

5 More on the constraint on C

In section 4 we saw evidence that symmetry, as defined in (12), cannot be broken in C. This strengthened our earlier claim about the ability of F to break symmetry and

provided further support for our proposal of a unified, structure-based definition of formal alternatives for SI and AF. However, we would like to have a better understanding of what it is about C that prevents it from breaking symmetry. In this section we will consider two possible views of the process of contextual restriction that would give C the desired property.

5.1 Relevance

A first attempt to define C so as to prevent it from breaking symmetry can be made by taking it to be the set of *relevant* sentences, on certain natural assumptions about relevance. Von Fintel and Heim (1997; as reported in Fox, 2007a) provide the following reasoning. On the assumption that S is relevant exactly when it is relevant to know whether S is true, we cannot consider S relevant without considering $\neg S$ as relevant as well (since knowing whether S is the same as knowing whether $\neg S$). Similarly, if S_1 and S_2 are both relevant, it seems natural to assume that $S_1 \wedge S_2$ is relevant as well. In other words, relevance must be closed under negation and conjunction:[25]

(50) Closure assumptions for relevance
   a. If S is relevant, so is $\neg S$
   b. If S_1, S_2 are relevant, so is $S_1 \wedge S_2$

Assume further that an assertion or a prejacent of *Only* is always relevant (along the lines of Grice's Maxim of Relevance).[26] Consider now an assertion or a prejacent S, which has symmetric alternatives, S_1 and S_2, and assume that S_1 is relevant. By (50a), $\neg S_1$ is relevant, and since S is relevant by assumption, we can use (50b) to obtain that $S \wedge \neg S_1$ is relevant as well. But by our definition of symmetry, $S_2 = S \wedge \neg S_1$, so we conclude that S_2 is also relevant. That is, whenever one of two symmetric alternatives is relevant, so is the other. On the assumption that C is the set of relevant sentences, then, we obtain the result that it cannot break symmetry.

Relevance, we haved just seen, offers a natural definition of C that makes the correct prediction regarding symmetry-breaking. For example, it can account for the missing SI in sentences like (42a) above, repeated here, along with its alternatives.

(51) John did some of the homework yesterday, and he did just some of the homework today
      *SI: ¬ John did just some of the homework yesterday

(52) Alternatives:
   a. John did just some of the homework . . .
   b. John did all of the homework . . .

To generate the missing SI, we would need context to provide a set of alternatives C that would have (52a) as a member but not (52b). But if C is the set of relevant

[25]These closure properties hold also for more articulated notions of relevance, such as those in Groenendijk and Stokhof (1984) and Lewis (1988).

[26]If SIs are computed by a focus-sensitive operator, we could talk uniformly about the prejacent being always relevant.

sentences, the assertion (51) must be a member of C, and since (52b)=(51)∧¬(52a), the closure assumptions for relevance entail that if (52a) is a member of C, (52b) must also be a member of C.

5.2 Exhaustive relevance

While the definition of C as the set of relevant sentences makes the correct predictions about missing SIs in cases of symmetry, as in (51), the definition might not be restrictive enough. Evidence that this is the case comes from the absence of an SI in the minimally different (53).

(53)   Yesterday, John talked to Mary or Sue, and today, John talked to Mary
       *SI: ¬ Yesterday, John talked to Mary

(54)   Alternatives:
       a. John talked to Mary
       b. John talked to Sue

The alternatives to (53) listed in (54) are not mutually exclusive and therefore do not give rise to symmetry.[27] Consequently, the closure conditions in (50) would not prevent C from eliminating (54b) while keeping (54a). This, in turn, would make the incorrect prediction that (53) can have the SI ¬(54a).

As in our earlier discussion, one could try to prevent C from eliminating (54b) (while keeping (54a)) by requiring material that is explicitly present in the assertion to be present in C. In this case, the mention of Sue in (53) could be used to prevent the elimination of (54b), independently of our considerations. However, we would like to consider an alternative approach to the problem raised by (53), involving a strengthening of our closure condition.[28] The strengthening we wish to propose requires a departure from the notion of C as a set that is defined independently of F. Instead of asking whether A is the intersection of F with an allowable set provided by context we will ask whether A is an allowable restriction of F, in the following sense:

(55) A is an *allowable restriction* of F given an assertion (or a prejacent of *Only*) S
       if both of the following hold:
       a. $S \in A$
       b. No member of $F \setminus A$ is exhaustively relevant given A

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[27]Though see Singh (2008).

[28]Potential evidence that the closure condition should be modified comes from cases like (i), where the SI under discussion seems to be absent even though the material for the alternatives that have to be eliminated is not explicitly mentioned in the assertion:

 i. Yesterday, John talked to some girl, and today, John talked to Mary
     ?*SI: ¬ Yesterday John talked to Mary

Judgments are subtle, though the absence of the SI in (i) is supported by the oddness of responding to *Did John talk to Mary?* with *# No, he only talked to some girl*. We thus might need a way to block the elimination of (54b) by C that does not rely on the explicit mentioning of Sue in (53). We note, however, that the strengthening proposed in (55) below does not extend in an obvious way to (i) or to variants of (53) in which there are more than two disjuncts. We leave this issue for the future.

(56) p is *exhaustively relevant* given A if $Only_A(p)$, as defined in (18), is in the Boolean closure of A

To see how (55) helps in the case of (53), consider what happens if we try to generate the unavailable SI by restricting F to an A that includes (53) and (54a) but not (54b). Since (54b) is in F, it can only be eliminated from F in the process of contextual restriction if it is not exhaustively relevant given A. However, $Only(A)(54b) = (54b) \land \neg(54a) = ((54a) \lor (54b)) \land \neg(54a) = (53) \land \neg(54a)$, and $(53) \land \neg(54a)$ is in the Boolean closure of A.[29] This means that (54b) is exhaustively relevant given A, and so A is not an allowable restriction of F. We can conclude that (54b) cannot be eliminated by context, and the SI $\neg(54a)$ cannot be generated.[30]

6   Summary

We presented an argument for revising the theory of alternatives for SI and for AF. We provided evidence that in both cases, symmetry is sometimes broken systematically in a particular direction, and that this is accomplished by the set F of formal alternatives. Moreover, we argued that F is the only place where symmetry can be broken, and in particular that context can never break symmetry. We saw that Rooth's type-based definition of F must be changed, and we offered a structure-based definition that preserves the generality and focus sensitivity of the original while allowing for symmetry breaking. We suggested that the new definition of F is used both for AF and for SI. Finally, we discussed possible views of the process of contextual restriction that would derive its inability to break symmetry.

References

Abrusán, Márta. 2007. Contradiction and grammar: The case of weak islands. Doctoral Dissertation, MIT, Cambridge, MA.

Chemla, Emmanuel. 2009. Similarity: Towards a unified account of scalar implicatures, free choice permission and presupposition projection. Under revision for *Semantics and Pragmatics*.

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[29]If A includes other sentences, those too might be negated in $Only(A)(54b)$, but since they are also in the Boolean closure of A, the point will not be affected.

[30]Suppose that computing an SI for a sentence S involves parsing it as $Only(A)(S)$. Our condition on contextual pruning might now be stated as follows:

i. A is an allowable restriction of F (for both SI and AF) iff $A = F \cap \{p : Only(A)(p) \text{ is relevant}\}$

If we conceive of every set of sentences as a possible question (in Hamblin (1973)'s sense), we can think of (i) as the requirement that contextual pruning yield a question which contains exactly the members of F that are relevant as its exhaustive answers. It is easy to see that (i) would be violated if context were to prune (54b) from A, so that $Only(A)(53)$ were to entail $\neg(54a)$. Under such a pruning, $Only(A)(53)$ is equivalent to $Only(A)(54b)$, and since the former is relevant by Grice's Maxim of Relevance, the latter is relevant as well, and hence could not be pruned by (i).

Chierchia, Gennaro. 2004. Scalar implicatures, polarity phenomena, and the syntax/pragmatics interface. In *Structures and beyond*, ed. A. Belletti. Oxford University Press.

Chierchia, Gennaro. 2006. Broaden your views: Implicatures of domain widening and the "logicality" of language. *Linguistic Inquiry* 37:535–590.

Chierchia, Gennaro, Danny Fox, and Benjamin Spector. 2008. The grammatical view of scalar implicatures and the relationship between semantics and pragmatics. In *Handbook of semantics*, ed. Paul Portner, Claudia Maienborn, and Klaus von Heusinger. New York, NY: Mouton de Gruyter.

von Fintel, Kai. 1994. Restrictions on quantifier domains. Doctoral Dissertation, University of Massachusetts-Amherst.

von Fintel, Kai, and Danny Fox. 2002. Classnotes for 24:954: Pragmatics in linguistic theory. DSpace. URL `http://hdl.handle.net/1721.1/36355`.

von Fintel, Kai, and Irene Heim. 1997. Classnotes on pragmatics. MIT.

Fox, Danny. 2007a. Free choice disjunction and the theory of scalar implicatures. In *Presupposition and implicature in compositional semantics*, ed. Uli Sauerland and Penka Stateva, 71–120. Palgrave-Macmillan.

Fox, Danny. 2007b. Too many alternatives: Density, symmetry and other predicaments. In *Proceedings of SALT 17*.

Grice, Paul. 1989. *Studies in the way of words*. Cambridge, MA: Harvard University Press.

Groenendijk, Jeroen, and Martin Stokhof. 1984. Studies in the semantics of questions and the pragmatics of answers. Doctoral Dissertation, Universiteit van Amsterdam, Amsterdam.

Hamblin, C. L. 1973. Questions in Montague English. *Foundations of Language* 10:41–53.

Horn, Laurence. 1972. On the semantic properties of the logical operators in English. Doctoral Dissertation, UCLA.

Horn, Laurence. 2000. From IF to IFF: Conditional perfection as pragmatic strengthening. *Journal of Pragmatics* 32:289–326.

Kadmon, Nirit. 2001. *Formal pragmatics: Semantics, pragmatics, presupposition, and focus*. Oxford: Blackwell.

Katzir, Roni. 2007. Structurally-defined alternatives. *Linguistics and Philosophy* 30:669–690.

Katzir, Roni. 2008. Structural competition in grammar. Doctoral Dissertation, MIT, Cambridge, MA.

Kratzer, Angelika. 1989. An investigation of the lumps of thought. *Linguistics and Philosophy* 12:607–653.

Krifka, Manfred. 1995. The semantics and pragmatics of polarity items. *Linguistic Analysis* 25:1–49.

Kroch, Anthony. 1972. Lexical and inferred meanings for some time adverbials. Quarterly Progress Reports of the Research Laboratory of Electronics 104, MIT, Cambridge, Mass.

Lewis, David. 1988. Relevant implication. *Theoria* 54:161–174.

Magri, Giorgio. 2009. A theory of individual-level predicates based on blind mandatory scalar implicatures. *Natural Language Semantics* 17:245–297.

Matsumoto, Yo. 1995. The conversational condition on Horn Scales. *Linguistics and Philosophy* 18:21–60.

van Rooij, Robert, and Katrin Schulz. 2004. Exhaustive interpretation of complex sentences. *Journal of Logic, Language and Information* 13:491–519.

Rooth, Mats. 1985. Association with focus. Doctoral Dissertation, University of Massachusetts, Amherst.

Rooth, Mats. 1992. A theory of focus interpretation. *Natural Language Semantics* 1:75–116.

Sauerland, Uli. 2004a. On embedded implicatures. *Journal of Cognitive Science* 5:107–137.

Sauerland, Uli. 2004b. Scalar implicatures in complex sentences. *Linguistics and Philosophy* 27:367–391.

Sevi, Aldo. 2005. Exhaustivity: A semantic account of 'quantity' implicatures. Doctoral Dissertation, Tel-Aviv University.

Singh, Raj. 2008. On the interpretation of disjunction: Asymmetric, incremental, and eager for inconsistency. *Linguistics and Philosophy* 31:245–260.

Singh, Raj. 2010. A note on ignorance inferences. Handout of talk presented at MOSAIC, June 2010.

Spector, Benjamin. 2006. Aspects de la pragmatique des opérateurs logiques. Doctoral Dissertation, Université de Paris 7, Paris.

Westerstahl, Dag. 1984. Determiners and context sets. In *Generalized quantifiers in natural language*, ed. Johan van Benthem and Alice ter Meulen, 45–71. Dordrecht: Foris.

Zondervan, Arjen. 2009. Experiments on QUD and focus as a contextual constraint on scalar implicature calculation. In *Semantics and Pragmatics: From Experiment to Theory*, ed. Uli Sauerland and Kazuko Yatsushiro. Palgrave-Macmillan.