On the Characterization of Alternatives*

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1 Introduction

The computation of both Scalar Implicatures (SI) and Association with Focus (AF) is characterized with reference to sets of alternatives. However, it has generally been assumed that the relevant alternatives are determined in different ways for the two processes. Specifically, it has been assumed that the alternatives for SI – scalar alternatives – are computed by a special procedure specifically designed for implicatures, whereas the alternatives for AF – focus alternatives – are determined by the general theory of association with focus – focus semantics. As far as we know, the only attempt to connect the two is Krifka (1995), under which scalar alternatives and focus alternatives are identical and determined by focus semantics. However, Krifka's result is based on a specific stipulation about scalar items, which he borrows from Horn and incorporates into focus semantics, namely that scalar items are inherently focused and have their Horn Scale as their lexically specified focus values.

The goal of the current paper is to argue for an alternative way of connecting SI to AF. Like Krifka, we will claim that scalar alternatives are constrained by focus semantics, but unlike Krifka, our claim will not depend on specific stipulations about the focus of scalar items. Instead, our proposal will depend on an approach to scalar alternatives argued for in Katzir (2007). This approach eliminates the need to appeal to any lexical stipulations such as Horn Scales in the definition of scalar alternatives, relying instead on a general notion of structural complexity. We will adopt this approach but modify it so that it can turn into a general theory of focus alternatives. The result is a reduction of SI to AF, where the formal constraint on scalar alternatives is determined directly by focus semantics.

Our argument will revolve around situations where a linguistic expression S is equivalent to the disjunction of two of its stronger alternatives S_1 and S_2, which in turn contradict each other. We will call S_1 and S_2 *symmetric* alternatives of S. Various reasons have been brought up in favor of the conclusion that symmetric alternatives do not generate SIs. We argue that a parallel state of affairs holds for the focus sensitive operator *only*, and that in both cases the facts motivate a constraint on the ability of context to prune formal alternatives. More specifically, although formal alternatives

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can generally be pruned by context in both SI and AF, we claim that context can never break symmetry: if there are symmetric alternatives before contextural pruning applies, pruning one of the alternatives is impossible without pruning the other one as well. We then show that this conclusion is incompatible with the standard focus semantics of Rooth (1985), but is compatible with a complexity based theory, which has the extra advantage of extending to SI.

If we are right, there will be obvious ramifications for the theory of AF as well as that of SI. For one thing, the theory of SI will have to be modified as proposed in Katzir (2007), but that, in turn, would have to be further adapted to incorporate focus sensitivity. The theory of AF will also have to be modified so that it is based on structural complexity rather than on semantic type. Furthermore, a very specific claim about the relationship between grammar and context will be needed. Specifically, context will not be able to pick and choose a random set of salient alternatives from the focus value of a sentence, as assumed in Rooth's work. Instead, contextual restriction will have to treat symmetric alternatives on a par: if one member of a symmetric pair is pruned, the other will have to be pruned as well. Finally, the fact that focus semantics is so central for SI will lend some measure of support to theories of SI that are based on focus sensitivity (Krifka, 1995, Fox, 2007, Chierchia, 2006, and Chierchia, Fox, and Spector, 2008).

To sum up our main claims will be the following:

(1) Main claims:
  a. Alternatives for both SI and AF are determined in the same way
  b. The set of alternatives in both cases is a contextual restriction of the focus value of the sentence (that is, computing SI involves AF).
  c. Contextual restriction is subject to a constraint that prevents it from breaking symmetry
  d. Focus values are determined based on structural rather than semantic (type-theoretic) considerations

Before we proceed to our argument, we will briefly review in the remainder of this introduction the common assumptions about the role of grammar and context in determining the alternatives for SI and AF. We will see that the general view of SI and AF is very different. In particular (1a) and (1b) are often denied. In the case of SI, as we will see in section 1.1, (1c) is often assumed, at least implicitly, which prevents a type theoretic definition of alternatives and motivates a totally different conception along lines developed by Horn (1972, 1989). In the case of AF, as we will see in section 1.2, a type theoretic definition of alternatives is very commonly accepted (Rooth, 1985, 1992). Our main argument will be based on the observation in section 2 that (1c) is a general law of contextual restriction and thus a type theoretic definition of alternatives is not viable for either SI or AF. This will eliminate the arguments against a uniform theory of SI and AF. However, the general conception of alternatives developed by Horn is clearly inappropriate for AF. We will resolve this impasse in section 3, by adopting the alternative proposal of Katzir (2007), modified so as to introduce focus sensitivity. This will be our version of (1d), which will allow us to maintain (1a) and

(1b). Finally in section 4 we will discuss a possible strengthening of the constraint in (1c).

1.1 Scalar Implicature

Following are some simple sentences with their SIs:[1]

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

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

(4) 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, $N_{SI}(A, S)$:[2]

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

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

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

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 alternatives. $F(S)$, in turn, is obtained from S by replacing certain items, *scalar items*, with members of a set of stipulated alternatives, often referred to as *Horn Scales*.

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

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:

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

C is invoked since, as already observed by Horn (1972, p. 112), different SIs are generated in different contexts. For example, the following are optional strengthened meanings for (2):

(9) Optional SMs for (2):

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[1]The brackets in examples (2) to (4) are included to mark the scope of negation. For readability purposes we will omit the brackets in subsequent examples, but the scope of negation will still be maximal.

[2]A question that we will mostly ignore in what follows concerns the definition of $N(A, S)$, the elements in A that are negated. It has often been assumed, following Grice, that the members of $N(A, S)$ are all strictly stronger than S. See Fox (2007) and Chierchia, Fox, and Spector (2008) for arguments that $N(A, S)$ should include also elements that do not stand in an entailment relation with S.

a. (2) and ¬ John did most of the homework

b. (2) and ¬ John did all of the homework

Restricting the alternatives using the formally defined $F(S)$ is needed 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 derive an SI using an alternative S_1, there is always another potential alternative, $S_2 = S\&\neg S_1$, which, if taken into account, would prevent the desired inference from arising. For example, consider (4) above, repeated here as (10), along with two of its potential alternatives, listed in (11).

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

(11) Potential alternatives:

a. John read four books

b. John read exactly three books

To derive the SI of (4), we must be able to negate (11a) but not (11b). On standard assumptions, this is accomplished by including the former but not the latter in the set of formal alternatives. This result is usually stated as a property of Horn Scales: *three* and *four* are scale-mates; *three* and *exactly three* are not. 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. $[\![S_1]\!], [\![S_2]\!] \subset [\![S]\!]$, and

b. $S_1 \Leftrightarrow S \wedge \neg S_2$

(13) Standard assumption: Symmetry for SI is broken by F
(11a)$\in F(4)$ and (11b)$\notin F(4)$

Below we will see evidence that (13) is indeed correct, and that symmetry breaking is only done by F.

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: ¬ John introduced Jane to Sue

(15) John only introduced Mary to Sue$_F$
Inference: ¬ John introduced Mary to Jane

(16) John only has three$_F$ children
Inference: ¬ John has four children

A sentence of the form $Only(S)$ entails the negation of various alternatives A to S. We will start by defining $EXC_A(S)$, the result of negating members of a subset of A, $N_{AF}(A, S)$:[3]

(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 (6) above:

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

As with SI, our concern will again be the question of how A is determined.[4] Here, too, the answer in the literature (Rooth, 1985, 1992) has been that A is a contextually determined subset of the set $F(S)$ of formal alternatives, but the definition of $F(S)$ in this case is taken to follow from a general, non-stipulative definition in terms of semantic types: each focused constituent contributes as alternatives all the possible denotations of the same type.

(19) $F(S) = \{S' : S'$ *is the result of replacing focused items in S with their focus 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:

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

C is invoked since, as noted by Rooth (1985, pp. 42–3), different entailments are generated in different contexts. Restricting the alternatives using the formally defined $F(S)$ is needed in order to account for focus sensitivity.

We observe that the same symmetry problem discussed for SI arises for AF:

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

(22) Potential alternatives:
a. John read four books
b. John read exactly three books

The inference from (21) requires negating (22a) and not negating (22b). Here, however, the familiar definition of focus values precludes the breaking of symmetry in F: *[$_{VP}$read four books]* and *[$_{VP}$read exactly three books]* are of the same semantic type, so if (22a) is an alternative to (21), so is (22b). On these assumptions, then, symmetry in AF must be broken in C:

[3]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).

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

(23) Standard assumption: Symmetry for AF is broken by C
In (21), (22a)$\in C$ and (22b)$\notin C$

Below we will see evidence that (23) is incorrect, and that in AF, as in SI, symmetry breaking can only take place in F, as we claimed in (1c).

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 is the following:[5]

(24) Difference between SI and AF (on the standard view): 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:

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

Of course, (25) 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. To make our argument, we will first present evidence, in section 2, that C, the contribution of context, is subject to a constraint that prevents it from filtering out alternatives in certain cases. In particular, it will sometimes be possible to construct F in such a way that it will contain two symmetric alternatives in the sense of (12) above. We will argue that both in SI and in AF, when symmetry of this kind arises, C cannot be used to remove one of the two conflicting alternatives:

(26) Claim: Symmetry cannot be broken in C. Specifically, if $S_1, S_2 \in F(S)$ are symmetric alternatives of S, then

a. S will never have $\neg S_1$ as an SI

b. *Only*(S) will never entail $\neg S_1$

From this we will conclude that when symmetry does not arise (that is, when $\neg S_1$ is an SI of S or an entailment of *Only*(S)), it is F that excludes one of the alternatives from $N(A, S)$.[6] This conclusion will be particularly significant for AF, where, as mentioned

[5] As mentioned in footnotes 2 and 4 above, another difference on the standard view concerns the definition of $N(A, S)$: for SI, the negated alternatives are those that are *stronger* than S, while for AF, the negated alternatives are the larger set of *non-weaker* alternatives. This difference, which is challenged in Fox (2007) and Chierchia, Fox, and Spector (2008), will not directly affect our discussion.

[6] We have deliberately ignored $N(A, S)$ in our discussion. The reason we can do that is that, as argued by Fox (2007) (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.

above, F is commonly defined in a way that gives rise to symmetry. On the other hand, we also mentioned that the standard definition of F for AF is general, contrasting with the stipulative mechanism of scales for SI. What we would like is a shared definition of F for SI and AF that will have the generality of Rooth's definition of F for AF, yet will have the ability of Horn Scales to break symmetry. In section 3 we will suggest a revision of F that has these properties. Section 4 discusses possible characterizations of C that would give the right results for symmetry breaking.

2 *C* does not break symmetry

2.1 Breaking symmetry in SI

Consider the following disjunction:[7]

(27) John did all of the homework or none of the homework

As argued by Sauerland (2004b), (27) has the following two alternatives (among others):

(28) a. John did all of the homework
b. John did none of the homework

Evidence that both disjuncts are indeed among the alternatives comes, among other considerations, from the embedding of (27) under a universal operator (see Sauerland, 2004a; Spector, 2006; Fox, 2007):[8]

(29) 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

(30) 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 (29) and (30), the universal operator guarantees that the alternatives obtained by taking a single disjunct will not be symmetric. In the original (27), on the other hand, symmetry holds. If C could eliminate one of the alternatives in (28) while keeping the other, we would expect to find the negation of the remaining alternative as an SI. Crucially, however, (27) cannot have the negation of either of the alternatives in (28)

[7] The reason we have chosen the particular disjunction in (27) 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 the purpose of our claims in (1), 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 4.

[8] 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. Cohen, 1971; Chierchia, 2004).

as an SI. In this case, then, our claim in (26) seems to hold: C cannot break symmetry for (27).

We have tried to present an argument against symmetry breaking in C. In the case of (27), however, we might have a confound. Each of the alternatives in (28) is already present in some sense in the asserted (27). 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 alternatives, at least one of which is not made salient by previous discourse.

The following sentence has the desired property:[9]

(31) 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

One might ask why the sentence in (31) does not have as an SI the negation of the claim that John did just some of the homework yesterday, which together with the assertion in the first conjunct, would amount to the claim that yesterday John did all of the homework. A possible answer to this question, very much in line with standard assumptions, is that the alternative needed for generating this SI is not a member of the set of formal alternatives F, since it cannot be derived from the actual sentence by replacing a scalar item with its scale-mate. However, Katzir (2007) argues for an alternative, in the context of a different argument against an account of F_{SI} based on Horn Scales. Specifically, Katzir argues that the absence of an SI in (31) is due to symmetry: *some of the homework* in the first conjunct will have both of the sentences in (32) as alternatives.

(32) a. John did just some of the homework ...
b. John did all of the homework ...

As in the disjunctive examples above, we can use embedding under a universal operator to show that both sentences in (32) are indeed available as alternatives:

(33) 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 (33) 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, (34a) and (34b), are compatible with each other and with the assertion (that is, the universal modal eliminates the symmetry).[10]

[9]Sentence (31) is based on examples discussed by Katzir (2007) and modified, in turn, from an example by Matsumoto (1995).

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

(34) 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*:

(35) Last week I gave an exam to the third graders who are an extremely well 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 (27) above. As with (27), embedding under a universal shows that we are dealing with true symmetry in F. And in both cases, a theory that disallows symmetry breaking in C predicts correctly the absence of an SI. The difference is that (27) left possible an alternative explanation for the absence of SIs, namely that explicitly mentioned material is obligatorily included in C. In (31), on the other hand, this alternative explanation would not help. This takes care of the confound, leaving us with what we feel is a real argument against symmetry breaking in C.

2.2 Breaking symmetry in AF

The pattern of symmetry and its breaking we just saw for SIs repeats itself with AF:

(36) In last week's robbery they only [stole the books]$_F$. In today's robbery they [stole the books but not the jewelry]$_F$
*Inference: ¬ In last week's robbery they stole the books but not the jewelry

(36) does not support the inference that in last week's robbery they stole the books and the jewelry. Such an inference would arise from negating the alternative *In last week's robbery they stole the books but not the jewelry*. This alternative can be derived from the argument of *only* in (36) by replacing the VP *stole the books* with *stole the books but not the jewelry*. Our explanation for the unavailable inference is the same as for the parallel SI cases above: F for (36) involves symmetry, and C is incapable of breaking symmetry. Specifically, F for (36) includes not only the alternative with *stole the books but not the jewelry*, as in (37a), but also the result of replacing the VP with *stole the books and the jewelry*, as in (37b):

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

1. 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!

2. 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!

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

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

(38) By last week they only found out that the robbers [stole the books]$_F$. Today they found out that the robbers [stole the books but not the jewelry]$_F$
Inference: ¬ By last week they found out that the robbers stole the books but not the jewelry
Inference: ¬ By last week they found out that the robbers stole the books and the jewelry

We conclude that in AF, too, C cannot break symmetry, leaving all symmetry breaking to F. Our conclusion requires a greater departure from standard assumptions in the case of AF than in the case of SI. The reason is that, as mentioned in section 1, Horn (1972)'s mechanism of scales allows symmetry breaking for SI in F, while for AF, Rooth (1985)'s theory of focus alternatives builds alternatives that are symmetric (for any type ending in t), so symmetry breaking can only happen in C.

3 Breaking symmetry in F

In the previous section we arrived at a requirement that, both for SI and for AF, symmetry can only be broken in F, and never in C. We further noted that the theory of scalar alternatives allows for some symmetry breaking in F, while the 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. Our definition will involve substitutions of structures for more complex structures within focused constituents. Before we proceed, we would like to review evidence that the restriction to focused constituents is needed not only for AF but also for SI.

3.1 Evidence that the computation of SIs is focus sensitive

As noted by Rooth (1992), the placement of focus affects the possible inferences that an utterance gives rise to, even in the absence of an overt focus-sensitive operator:

(39) How did the exam go?
a. Well, I [passed]$_F$
b. Well, [I]$_F$ passed

The two answers in (39), differing only in the placement of focus, license different inferences. (39a), 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. (39b), 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 (40), 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 (41) where the VP is not focused.

(40) a. What did John do yesterday?
b. He [talked to Mary or Sue]$_F$

(41) 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.

3.2 A new theory of association with focus

An attempt to eliminate the stipulations from the theory of SIs is presented in Katzir (2007), in which F is defined in terms of structural complexity. We propose to use a similar definition of alternatives, though we would need to localize the use of the alternatives to focused constituents.

The definition of F in Katzir (2007) makes use of a notion of structural complexity in a given context, $\lesssim_C$. Simplifying somewhat, we can define the following relation of `at-most-as-complex-as`:

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

(43) $SS(X, C)$, 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[11]

Using these definitions, we can now 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.[12]

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

[11]In Katzir (2007) the set (43c) is defined as the set of constituents introduced in previous discourse. Evidence for the inclusion of salient constituents in the substitution source comes from the SIs of sentences such as (33) above.

[12]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 $F(S, C)$.

The definition in (44) 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 *just some* are all of type $< et, < et, t >>$, only *some* and *all* are of the same complexity, and *just some* is strictly more complex (as long as context does not add *just some* to the substitution source, as allowed by (43c), making *just some* equally complex). This means that by the type-based definition, an occurrence of *some* will bring in *all* and *just some* 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 More on the constraint on C

We saw that symmetry, as defined in (12), cannot be broken in C. For the purposes of our argument that both for SI and for AF F should be allowed to break symmetry and hence cannot be defined in terms of semantic type, this is sufficient, thus supporting our claim in (1d). 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 have the desired property.

4.1 Relevance

A first attempt to define C so as to prevent it from breaking symmetry is 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, 2007) 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:[13]

(45) 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 is always relevant (as in Grice's Maxim of Relevance). Consider now an assertion of a sentence S, which has symmetric alternatives, S_1 and S_2, and assume that S_1 is relevant. Since S was asserted, it is also relevant. By (45) we obtain that $\neg S_1$ is relevant, and consequently that $S \wedge \neg S_1$ is relevant. 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

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

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, provides us a natural definition of C that makes the correct prediction regarding symmetry breaking. Consequently, it can account for the missing SI in sentences like (31) above, repeated here, along with its alternatives.

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

(47) 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 (47a) as a member but not (47b). But if C is the set of relevant sentences, the assertion (46) must be a member of C, and since (47b)=(46)∧¬(47a), the closure assumptions for relevance entail that if (47a) is a member of C, (47b) must also be a member of C.

4.2 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 (46), the definition might not be restrictive enough. Evidence that this is the case comes from the absence of an SI in the minimally different (48).

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

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

The alternatives to (48) listed in (49) are not mutually exclusive and therefore do not give rise to symmetry.[14] Consequently, the closure conditions in (45) would not prevent C from eliminating (49b) while keeping (49a). This, in turn, would make the incorrect prediction that (48) can have the SI ¬(49a).

As in our earlier discussion, one could try to prevent C from eliminating (49b) by requiring material that is explicitly present in the assertion to be present in C. In this case, the mention of Sue in (48) could be used to prevent the elimination of (49b), independently of our considerations. However, we would like to consider an alternative approach to the problem raised by (48), involving a strengthening of our closure condi-

[14] Though see Singh (2008).

tion.[15] 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 context we will ask whether A is an allowable restriction of F, in the following sense:

(50) A is an *allowable restriction* of F if no member of $F \setminus A$ is exhaustively relevant given A

(51) p is *exhaustively relevant* given A if $Only_A(p)$, as defined in (18), is in the Boolean closure of A[16]

We will further assume that if S is asserted then it is also exhaustively relevant. To see how exhaustive relevance helps in the case of (48), consider what happens if we try to generate the unavailable SI by restricting F to an A that includes (48) and (49a) but not (49b). Since (49b) is in F, it can only be eliminated if it is not exhaustively relevant given A. However, *Only*(A)(49b) =(49b)∧¬(49a)=((49a)∨(49b))∧¬(49a)=(48)∧¬(49a), and (48)∧¬(49a) is in the Boolean closure of A.[17] This means that (49b) is exhaustively relevant given A, and so A is not an allowable restriction of F. We can conclude that (49b) cannot be eliminated by context, and the SI ¬(49a) cannot be generated.

5 Discussion

We presented an argument for revising the theory of alternatives for SI and for AF. We showed that in both cases, contextual restriction is incapable of breaking symmetry. Consequently, whenever symmetry is broken and an SI or an inference due to AF arises, it must be F that eliminated one of the symmetric alternatives. We saw that Rooth's type-based definition of F must be changed, and we offered a structure-based definition that preserves the generality of the original while allowing for symmetry breaking. The same structure-based definition of F for AF allowed us to address two concerns about the scale-based definition of F for SI: generality and focus-sensitivity. 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.

[15] 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, but if the SI is indeed absent in (i), we need a way to block the elimination of (49b) by C that does not rely on the explicit mentioning of Sue in (48). We note, however, that the strengthening proposed in (50) below does not extend in an obvious way to (i) or to variants of (48) in which there are more than two disjuncts. We leave this issue for the future.

[16] Put differently, p is exhaustively relevant given A if p as an exhaustive answer to A is relevant. See Fox (2007) for further discussion. Note that if p is in the Boolean closure of A, then so is *Only*(A)(p). This, in turn, means that if p is relevant then it is also exhaustively relevant.

[17] If A includes other sentences, those too might be negated in *Only*(A)(49b), but since they are also in the Boolean closure of A, the point will not be affected.

References

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.

Cohen, Laurence Jonathan. 1971. Some remarks on Grice's views about the logical particles of natural language. In *Pragmatics of natural language*, ed. Yehoshua Bar-Hillel, 50–68. Reidel.

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. 2007. 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.

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

Groenendijk, J., and M. Stokhof. 1984. Studies on the semantics of questions and the pragmatics of answers. Doctoral Dissertation, University of Amsterdam, Amsterdam.

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

Horn, Laurence. 1989. *A natural history of negation*. Chicago: University of Chicago Press.

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

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

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

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.

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

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.

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

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