

# Does the structural approach to alternatives give us just enough alternatives to solve the symmetry problem?

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**Abstract** The structural approach to alternatives (Katzir 2007, Fox & Katzir 2011) aims at solving the symmetry problem of scalar implicatures by referring to a notion of structural complexity of alternatives, but problematic data with so-called ‘indirect’ scalar implicatures have been raised (Romoli 2013, Trinh & Haida 2015). In an attempt to defend the structural approach from these problems, Trinh & Haida (2015) recently propose to augment the theory with what they call the atomicity constraint. In this paper, it is shown that the atomicity constraint falls short of explaining simple variants of the original problems, and moreover that it runs into trouble with the inference of sentences involving scalar adjectives like *full*. In addition to the problems above, two related problems are discussed, namely the problem of ‘too many lexical alternatives’ (Swanson 2010) and the problem of ‘too few lexical alternatives.’ These three problems epitomise the general difficulty of constructing just enough alternatives under the structural approach for solving the symmetry problem in the general case.

## 1 Introduction

### 1.1 Alternatives and the symmetry problem

Theories of scalar implicatures, while quite diverse, tend to have the following shape: the scalar implicature of a sentence  $S$  arises by deriving the negations of alternatives to  $S$ .<sup>1</sup> Schematically, the meaning of a sentence  $S$  strengthened with the scalar implicature can be written as  $\text{EXH}(C)(S)$ , where EXH is whatever mechanism

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<sup>1</sup> The main idea goes back to Grice’s (1967) and Horn’s (1972) work, followed by many others, such as Gazdar 1979, Chierchia 2004, Sauerland 2004, Fox 2007, Chierchia, Fox & Spector 2012. There are approaches that do not make use of alternative sentences to derive scalar inferences, e.g. Van Rooij & Schulz 2004, 2006 and Fine to appear. Our focus in this paper is the former kind of approach and specifically the structural theory of alternatives due to Katzir 2007 and Fox & Katzir 2011. We leave for another occasion the question of whether the issues raised herein for the structural approach are dealt with satisfactorily by theories that do away with alternative sentences.

deriving scalar implicatures—pragmatic reasoning or some formal mechanism—and  $C$  is a set of alternatives:<sup>2</sup>

- (1)  $\text{EXH}(C)(S) = S$  and the negation of each  $A \in C$  which is not weaker than  $S$  and does not contradict the negation of any  $A' \in C$  given  $S$ .

For instance, the derivation of the scalar implicature in (2b) arising from the sentence (2a) is assumed to involve a set  $C$  of alternatives in (3). EXH applied to (3) and (2a), negates the alternative ‘John did all of the homework’, thereby giving rise to the implicature (2b).

- (2) a. John did some of the homework.  
 b.  $\rightsquigarrow$  *John didn't do all of the homework*
- (3)  $C = \{ \text{John did some of the homework, John did all of the homework} \}$

Crucial to this explanation is the following question: given a sentence and a context, how can we determine the set of alternatives? It is well known in the literature that this question needs to be answered while avoiding the so-called ‘symmetry problem’ (Kroch 1972, Fox 2007, Katzir 2007, Fox & Katzir 2011 among others).

Schematically, the symmetry problem has the following form. Suppose that sentence  $S$  implicates  $\neg A$ , the negation of some alternative  $A$ . Then a sentence equivalent to  $S \wedge \neg A$  should not be in the set of alternatives. Concretely, (4) should not count as an alternative to (2a).<sup>3</sup>

- (4) John did some but not all of the homework.

If (4) is an alternative, its negation will give rise to the inference that John did all of the homework, which is not an attested inference of (2a). Furthermore, it is in contradiction with its intuitively correct inference in (2b), and thus EXH as defined in (1) will incorrectly block the actually attested scalar inference (2b).

<sup>2</sup> See the works cited in the previous footnote for more explicit definitions and in particular Fox (2007) for refinements of (1) with the notion of *innocent exclusion*.

<sup>3</sup> Notice that this way of characterising the symmetry problem is based on the idea that the alternatives that end up being negated by EXH are only the ones that are strictly stronger than the assertion. Once we move to a definition of EXH like the one above, which also excludes alternatives that do not stand in entailment relation with the assertion, then we have more symmetric alternatives that we have to deal with (for arguments in favour of moving from strictly stronger alternatives to non-weaker ones see Spector 2006, Chemla 2010, Fox 2007, Chierchia et al. 2012 among others). In particular, given a sentence  $S$  that implicates the negation of some alternative  $A$  then  $\neg A$  should not be in the set of alternatives. In the case above, (i) should not count as an alternative to (2a).

- (i) John didn't do all of the homework.

Therefore, given a sentence  $S$  and its attested inference  $\neg A$ , one needs a principled way to allow the alternative  $A$  and, at the same time, disallow the potential alternative  $S \wedge \neg A$  to be in the set of alternatives  $C$ , for, as we have just seen, if both of these alternatives were in  $C$ , we would derive no implicature at all, since the negation of  $S \wedge \neg A$  contradicts  $A$  given  $S$ .<sup>4</sup>

- (5) Let  $S, S_1, S_2$  be sentences such that  $S_1$  and  $S_2$  are alternatives to  $S$ . We say that  $S_1$  and  $S_2$  are *symmetric alternatives* of  $S$  if both of the following are true.
- a.  $\llbracket S \rrbracket \subseteq (\llbracket S_1 \rrbracket \cup \llbracket S_2 \rrbracket)$
  - b.  $\llbracket S_1 \rrbracket \cap \llbracket S_2 \rrbracket = \emptyset$

A standard solution to the symmetry problem stipulates that alternatives are restricted lexically (Horn 1972). That is, lexical items like ‘some’ and ‘all’ are marked in the lexicon to form a scale, and at the sentential level, alternative sentences are constructed only by replacing these scalar terms with their scale-mates. In this setting, the symmetry problem is avoided by the following lexical stipulation: ‘Some’ and ‘all’ are associated in a scale but ‘some’ and ‘some but not all’ are not.<sup>5</sup> Consequently the problematic alternative (4) will not be constructed out of (2a).

There are at least two problems with this view, however. First, the postulation of scales in the lexicon appears to lack an independent justification and to be *ad hoc*. Second, it is unclear how to handle ‘contextual implicatures’ where the scalar inference is based on a scale that is not lexically encoded but contextually determined on the fly, so to speak (Hirschberg 1991). To illustrate, consider, the following example.

- (6)
  - a. Mary got drunk. Did John?
  - b. He smoked pot.

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4 We modify Fox & Katzir’s (2011) original formulation, (i), which is only applicable to stronger alternatives, so as to deal with non-weaker alternatives too (see fn. 3), as such cases will be crucial for us.

- (i) Let  $S, S_1, S_2$  be sentences such that  $S_1$  and  $S_2$  are alternatives to  $S$ . We say that  $S_1$  and  $S_2$  are *symmetric alternatives* of  $S$  if both of the following are true.
- a.  $\llbracket S_1 \rrbracket \cup \llbracket S_2 \rrbracket = \llbracket S \rrbracket$
  - b.  $\llbracket S_1 \rrbracket \cap \llbracket S_2 \rrbracket = \emptyset$

5 To justify this Horn (1989) proposes that scales obey the *monotonicity constraint*, which states that scale-mates must all license entailments in the same direction (i.e. all of them are upward entailing, all of them are downward entailing or all of them are neither). However, since no independent motivation for it is given, it is unclear that the constraint is more than a generalization about what scales must be stipulated. Furthermore, Katzir (2007) argues that it is too strong and fails to account for certain examples. We will not reproduce Katzir’s argument here.

- c.  $\rightsquigarrow$  *John didn't get drunk*  
(7) He got drunk.

(6b) implicates (6c), but if (6c) is to arise from an alternative like (7), it is unclear how this can be constructed from (6b) by replacing scalar items, since there does not seem to be a scalar item in (6b) to begin with. If, on the other hand, ‘smoked pot’ was lexically marked as belonging to the same scale as ‘got drunk’, the implicature (6c) would wrongly be derived even in the absence of a prior utterance like (6a).

## 1.2 Katzir & Fox on formal alternatives

As an alternative to the lexical stipulation of scales, [Katzir \(2007\)](#) advocates the structural approach to alternatives that appeals to structural complexity. His theory makes use of formal alternatives, defined as follows.

- (8) The *formal alternatives* of sentence  $S$ , written  $F(S)$ , in context  $c$  are the set of sentences derivable by successive replacement of constituents of  $S$  with items in the *substitution source* of  $S$  in  $c$ .

The notion of substitution source is in turn defined as follows:

- (9) An item  $\alpha$  is in the *substitution source* of  $S$  in  $c$  if
- $\alpha$  is a constituent that is salient in  $c$  (e.g. by virtue of having been mentioned); or
  - $\alpha$  is a sub-constituent of  $S$ ; or
  - $\alpha$  is in the lexicon.

If all formal alternatives were always employed to derive scalar implicatures, the theory would lead to massive over-generation of scalar implicatures. In order to block this, [Katzir \(2007\)](#) assumes that the context restricts  $F(S)$  into a subset  $C$  that only consists of the formal alternatives that are ‘relevant.’

Before moving to the notion of relevance, let us first go back to (2a) to see how formal alternatives help us derive the inference and circumvent the symmetry problem at the same time. The most important part of [Katzir’s](#) analysis is that it excludes the symmetric alternative (4) by referring to its relative structural complexity. That is, since (4) is structurally more complex than (2a), it simply cannot be obtained from (2a) by successive replacements of constituents with items in the substitution source (unless the constituent ‘some but not all’ is contextually salient; we’ll come back to this shortly). (2b), on the other hand, can be generated by replacing ‘some’ with ‘all’, which are of equal structural complexity.

The definition of formal alternatives in (8) also naturally deals with contextual implicatures, unlike lexically stipulated scales. Specifically, as defined in (9), contextually salient alternative constituents can participate in constructing alternatives. In (6), for example, the VP ‘got drunk’ is a contextually salient constituent, which can be used to derive (7) from (6b). Thus, if the set of relevant alternatives  $C$  here includes (7), the desired scalar implicature can be derived.<sup>6</sup>

Importantly,  $C$  should not be allowed to be any subset of the formal alternatives  $F(S)$ . This can be illustrated by (10), discussed by Katzir (2007) and Fox & Katzir (2011).<sup>7</sup>

(10) ??John did some of the homework yesterday, and he did some but not all of the homework today.

This example is odd, but it is fairly clear that (10) does not have a scalar implicature to the effect that John did *all* of the homework yesterday.<sup>8</sup> However, if  $C$  can be any subset of  $F(S)$ , this scalar implicature is predicted to be possible, namely, when  $C$  contains the contextually salient alternative ‘some but not all’ but not ‘all’.

(11)  $C = \left\{ \begin{array}{l} \text{John did some of the homework yesterday,} \\ \text{John did some but not all of the homework yesterday} \end{array} \right\}$

This set of alternatives will give rise to the negation of ‘John did some but not all of the homework yesterday’ as a scalar implicature, which together with the assertion entails that John did all of the homework yesterday.

Fox & Katzir (2011) deal with this issue by assuming that the restricted set  $C$  of relevant alternatives is constrained by the following closure condition.<sup>9</sup>

<sup>6</sup> One might wonder whether lexical substitution could be used to derive the alternative (7). This might be the case for the particular example at hand, but it would not work for others where the alternative is clearly structurally more complex:

- (i) a. Prof Jones read my paper and gave me useful comments on it. Did Prof Smith do the same for you?
- b. He read my paper.
- c.  $\rightsquigarrow$  *He didn't give useful comments*

<sup>7</sup> Fox & Katzir (2011) actually use ‘just some’ in place of ‘some but not all’, we modified for uniformity for the examples above, nothing changes for the point we want to make here.

<sup>8</sup> Fox & Katzir (2011) suggest that (10) has a reading where it does not implicate that John did not do all of the homework yesterday. To deal with this reading they propose that salient constituents are only ‘optionally’ salient. We will come back to this below.

<sup>9</sup> This is actually Trinh & Haida’s (2015) restatement of the condition by Fox & Katzir (2011). It simplifies somewhat from Fox & Katzir (2011), but as Trinh & Haida (2015) point out, the simplification is not relevant for present purposes. See fn. 15 of Trinh & Haida 2015.

- (12) *Closure condition on C*:
- a.  $C \subseteq F(S)$ ;
  - b.  $S \in C$ ; and
  - c. there is no  $S' \in F(S) \setminus C$  such that  $\llbracket S' \rrbracket$  is in the Boolean closure of  $C$ .

The first clause requires  $C$  to be a subset of the formal alternative and the second clause demands what is asserted to be in the set  $C$ . (12c) requires  $C$  to include sentences which express all Boolean combinations of sentences in  $C$ , provided that they are in  $F(S)$ . Here the Boolean closure of  $C$  is the smallest set of propositions such that it i) contains all the propositions in  $\{\llbracket S' \rrbracket \mid S' \in C\}$  and ii) contains  $\neg p$  and  $p \wedge q$  if it contains  $p$  and  $q$ .

The idea behind (12c) is the following intuition. If it is of interest in the context whether  $p$  is true or false, then it is of interest whether  $\neg p$  is. Thus if the former is included then so should be the latter, unless there's no formal alternative expressing it. Similarly, if it is relevant in the context whether  $p$  is true and whether  $q$  is true, then it will be relevant whether their conjunction is. Therefore, no formal alternative that expresses the Boolean closure of  $C$  should be left out.

By way of illustration, consider the following set of alternatives.

- (13)  $C = \{\text{John did some of the homework, John did all of the homework}\}$

This is a permissible set  $C$  of relevant alternatives for (2a) and will yield the scalar implicature that John did not do all of the homework. Note that not all propositions that are in the Boolean closure of  $C$  must be expressed by the sentences in  $C$ , because (12c) only demands an alternative to be not left out if it is a formal alternative. More concretely, the propositions expressed by the following sentences are in the Boolean closure of  $C$ , but these sentences are not formal alternatives, as there is no way to construct them given (8) (unless 'some but not all' and 'not all' are salient in the discourse; see below), so they need not be in  $C$ .

- (14) a. John did some but not all of the homework.  
b. John did not all of the homework.

Now coming back to (10), in this context 'some but not all' is salient, as it is mentioned in the second clause of the same sentence. Thus it is in the substitution source and 'John did some but not all of the homework yesterday' is a formal alternative. What we want to avoid is context to restrict the set of formal alternatives to a set like (11). Notice that  $\llbracket \text{all} \rrbracket = \llbracket \text{some and not}(\text{some but not all}) \rrbracket$  and hence 'John did some but not all of the homework' is equivalent to a sentence in the Boolean closure of  $C$ . Consequently, the closure condition prohibits 'John did all of the homework yesterday' from being left out from  $C$ , as it would be in (11).

In sum, the complexity-based approach advocated by [Katzir \(2007\)](#) and [Fox & Katzir \(2011\)](#) gives us a principled way to solve the symmetry problem for a sentence like (2a) and can also explain the contrast between (2a) and (10) by constraining the set  $C$  of relevant alternatives with the assumed closure condition.

### 1.3 The problem of indirect scalar implicatures

The complexity-based approach, however, runs into problem with so-called indirect implicatures, that is implicatures arising from a sentence containing a strong scalar item in a downward entailing context like negation, as pointed out by [Romoli \(2013\)](#). The crucial property of these cases is that unlike the examples we have seen so far, the asserted sentence is structurally more complex than the problematic symmetric alternative, and hence [Katzir's \(2007\)](#) substitution procedure automatically includes them as formal alternatives.

A case in point is given in (15a), which has a scalar implicature in (15b).

- (15) a. John didn't do all of the homework.  
 b.  $\rightsquigarrow$  *John did some of the homework*

To obtain (15b), the following alternative needs to be negated.

- (16) John didn't do some of the homework.

[Fox & Katzir](#), however, wrongly predict that this alternative cannot be negated, due to the presence of its symmetric alternative. Consider first the set of formal alternatives of (15a) that can be constructed according to the definition in (8). To avoid clutter in the examples, we will write alternatives in schematic form from now on, adopting [Trinh & Haida's \(2015\)](#) notation (whereby, for example, **all** = 'John did all of the homework').

- (17)  $F(15a) = \{ \neg \mathbf{all}, \neg \mathbf{some}, \mathbf{all}, \mathbf{some} \}$

Here we would like to negate  $\neg \mathbf{some}$  to obtain the inference (15b), but we cannot because we also have the symmetric alternative **some**, which is generated from (15a) by substituting the NegP in the assertion with its subconstituent VP as shown in (18).<sup>10</sup>

- |      |  |                                     |
|------|--|-------------------------------------|
| (18) | $[\text{NegP not } [\text{VP John did all of the homework}]]$<br>$\Rightarrow [\text{NegP not } [\text{VP John did some of the homework}]]$<br>$\Rightarrow [\text{VP John did some of the homework}]$ | (15a)<br>all/some<br>subconstituent |
|------|--|-------------------------------------|

<sup>10</sup> For expository purposes, we represent the subject in the VP-internal position and also the verb in the inflected form but nothing crucial hinges on this.

Given that **some** is in  $C$ , the negation of  $\neg$ **some** contradicts the negation of **some** and hence cannot be negated.

It should be considered at this point whether a subset  $C'$  of the formal alternatives containing  $\neg$ **some** but not **some** can be used instead, i.e.  $C' = \{\neg$ **all**,  $\neg$ **some**, **all** $\}$ , which could be used to derive the desired scalar implicature. It is easy to see, however, that  $C'$  violates the closure condition (12):  $F(3) \setminus C' = \{\mathbf{some}\}$  and **some** is in the boolean closure of  $C'$  given that  $\llbracket \mathbf{some} \rrbracket = \llbracket \neg \neg \mathbf{some} \rrbracket$ .

A similar problem arises with the slightly more complex example in (19) from Trinh & Haida (2015):<sup>11</sup>

- (19) Bill went for a run and didn't smoke.  
 John (only) went for a run.  
 $\rightsquigarrow$  *John smoked*

To get the inference in (19) we want to negate the alternative  $\mathbf{run} \wedge \neg \mathbf{smoke}$  so as to derive  $\neg(\mathbf{run} \wedge \neg \mathbf{smoke})$ , which together with the assertion ( $\mathbf{run}$ ) gives us the result we want, i.e. **smoke**. Note that the alternative  $\neg$ **smoke** could also be used to derive the desired scalar implicature, but due to the closure condition (and the way in which formal alternatives are constructed), we always also have **smoke**, which blocks this scalar implicature.

Here again, Fox & Katzir's (2011) system under-generates, for essentially the same reason as above. Specifically, the following set of formal alternatives can be generated for (19).

- (20)  $F(19) = \{\mathbf{run}, \neg \mathbf{run}, \mathbf{smoke}, \neg \mathbf{smoke}, \mathbf{run} \wedge \mathbf{smoke}, \mathbf{run} \wedge \neg \mathbf{smoke}\}$

As before, any set  $C$  containing the alternative that we need ' $\mathbf{run} \wedge \neg \mathbf{smoke}$ ' will also have to contain its symmetric alternative ' $\mathbf{run} \wedge \mathbf{smoke}$ ', because the latter is in

<sup>11</sup> It should be noted that context seems to play an important role in examples like (19), as Trinh & Haida (2015: §3.1) remark. For instance, unlike (19), (i) does not seem to give rise to a scalar implicature to the effect that Bill got Question 2 right, despite the fact that the structure of the sentences is essentially identical.

- (i) John got Question 1 right, but didn't get Question 2 right.  
 Bill got Question 1 right.

Trinh & Haida are aware of this type of examples and recognise that the structural theory of alternatives should be amended so that it could derive the relevant inference both in (19) and (i), while blocking it in the latter case by resorting to (arguably ill-understood) effects of context. It is also a logical possibility that these examples are outside of the purview of the structural theory of alternatives altogether, and the inference in (19) is generated by some other mechanism, although it is not immediately clear what that mechanism would be. Since our main concern is to show the difficulties that the structural theory of alternatives faces, in particular with Trinh & Haida's (2015) refinement, we will put the issue of the role of context in cases like (i) aside.

the Boolean closure of any set containing the former, given that  $\llbracket \mathbf{run} \wedge \mathbf{smoke} \rrbracket = \llbracket \mathbf{run} \wedge \neg(\mathbf{run} \wedge \neg\mathbf{smoke}) \rrbracket$ .

It should be noted here that Fox & Katzir (2011) actually put an additional constraint on the set of formal alternatives that requires replacements to be performed only on *focussed* parts of the sentence. If focus is narrow enough, i.e. below negation, as in (21a) or (21b), then the offending alternative **some** cannot be generated, as negation cannot be replaced here.

- (21) a. John didn't [do all of the homework]<sub>F</sub>  
b. John didn't do [all of the homework]<sub>F</sub>

Romoli (2013), however, points out that the scalar implicature is still observed, even when the focus is broad enough to include negation, as in the following example.

- (22) What happened at school today?  
[John (my favourite student) didn't do all of the homework]<sub>F</sub> .

Also, for (19), manipulating the focus structure would not solve the problem. Specifically, both of the following possibilities run into the same problem as before.

- (23) a. [John went for a run]<sub>F</sub>  
b. John [went for a run]<sub>F</sub>

Other possible focus structures obviously could not be used to derive the relevant alternative under the assumption that only focused parts of the sentence can be replaced.

At this point, one might consider changing the definition of EXH, so that it only negates stronger members of *C*, rather than all non-weaker ones. This would solve the problem because **some**, unlike its symmetric alternative  $\neg\mathbf{some}$ , is not stronger than  $\neg\mathbf{all}$ . As mentioned, however, there are arguments against this change. For instance, negating non-weaker alternatives is needed to deal with contextual scalar implicatures based on *ad hoc* scalar items as in (6a) (see also fn. 3). One might then wonder if a more sophisticated procedure could consider non-weaker alternatives for (6a) but not for (15a) and (19). This is precisely what Trinh & Haida (2015) propose.

## 2 Trinh & Haida's Atomicity Constraint and Its Problems

Adopting Katzir's (2007) and Fox & Katzir's (2011) structural approach to alternatives, Trinh & Haida (2015) propose to add one extra constraint on the construction of formal alternatives which prohibits further substitutions on the expressions in the substitution source. They state this constraint as follows:

- (24) **Atomicity constraint:** Expressions in the substitution source are syntactically atomic.

What (24) is effectively requiring is that all constituents in the substitution source, regardless of whether they are simple lexical items or complex phrases, be treated as if they were simple lexical items. So for instance, an entire phrase like [John did all of the homework] will be treated as if it was a single lexical item, like [John], that is invisible to syntax in its internal constituency.

Let us see how this solves the problem of indirect scalar implicatures. Remember that the problem with (25a) is that Fox & Katzir’s (2011) procedure allows us to construct both the needed alternative in (26a) and its symmetric alternative in (26b).

- (25) a. John didn’t do all of the homework.  
 b.  $\rightsquigarrow$  *John did some of the homework*
- (26) a. John didn’t do some of the homework.  
 b. John did some of the homework.

The atomicity constraint correctly blocks the generation of the offending alternative (26b). To see this, consider how it could be derived. We know the substitution source includes the atomic item ‘some.’ Using this, let us try the following derivation.

- (27) a. [<sub>NegP</sub> not [<sub>VP</sub> John did all of the HW]] (25a)  
 b. VP John did all of the HW subconstituent  
 c. VP John did [some] of the HW \*all/some

This derivation violates the atomicity constraint because after the second step, the subconstituent VP is now treated as an atom (as indicated by the box here), and its sub-part, ‘some’, cannot be replaced in the third step.

We should also consider the possibility of first substituting ‘some’ for ‘all’ and substituting the newly formed VP = [<sub>VP</sub> John did some of the homework]. However, this is not possible, simply because this VP is not in the substitution source. It is not a subconstituent of the assertion and it is not salient in the context. Consequently, the symmetric alternative (26b) (**some**) is not generated, and the correct indirect scalar implicature can be generated by negating (26a) ( $\neg$ **some**).

What if this VP is contextually salient instead? Consider the following example.

- (28) Two weeks ago, John did all of his homework. Last week, John did some of his homework. And this week, he didn’t do all of his homework.  
 $\rightsquigarrow$  *John did some of his homework*

The last sentence in this example clearly has the inference that John did some of the homework. Since ‘[<sub>VP</sub> John did some of the homework]’ is in the substitution

source by virtue of having been uttered in the previous sentence, it is predicted that the scalar implicature should be absent in this case, contrary to fact.

Both Fox & Katzir (2011) and Trinh & Haida (2015) are aware of this problem, and they propose that contextually salient alternatives are only optionally in the substitution source (see Fox & Katzir 2011: fn. 23 and Trinh & Haida 2015: fn. 22 and fn. 8 above). With this assumption, the scalar implicature is optionally derived for (28), which appears to be a correct prediction, as the scalar implicature could be seen as an optional inference (cf. (10)).

Let us now also see how Trinh & Haida’s (2015) example (19) is accounted for. The solution is essentially identical. Here we have  $\alpha =$  ‘[VP went for a run and didn’t smoke]’ as well as ‘smoked’ in the substitution source. Without the atomicity constraint, the offending alternative **run**  $\wedge$  **smoke** could be derived as follows:

$$\begin{array}{lll}
 (29) & \text{[John went for a run]} & \text{the prejacent} \\
 & \Rightarrow \text{[ John } \boxed{\text{VP went for a run and didn't smoke}} \text{ ]} & \text{T'/}\alpha \\
 & \Rightarrow \text{[ John } \boxed{\text{VP went for a run and [VP smoked]} \text{ ]} & \text{NegP/smoked}
 \end{array}$$

The atomicity constraint rules out this derivation, as the VP in the second step is atomic, and the replacement in the last step is forbidden. As a result, the formal alternatives are not going to include the offending alternative **run**  $\wedge$  **smoke** and  $C$  can be the following set, which gives rise to the correct scalar implicature.<sup>12</sup>

$$(30) \quad C = \{ \mathbf{run}, \neg\mathbf{run}, \mathbf{run} \wedge \neg\mathbf{smoke} \}$$

Thus, the atomicity constraint accounts for the examples in (15a) and (19). However, we now show with more examples that the atomicity constraint does not provide a general solution to the problem of indirect scalar implicatures. We discuss two sets of data. One is a simple variant of Trinh & Haida’s (2015) example (19). The other has to do with the indirect scalar implicature that scalar adjectives like *full* give rise to when embedded under negation.

## 2.1 Contextual implicatures without conjunction

Consider a conjunctionless variant of Trinh & Haida’s (2015) example (19), given in (31). Intuitively, the second sentence has the same inference as (19), namely that John smoked.

<sup>12</sup> We include  $\neg\mathbf{run}$  here, which is contextually salient, but its presence has no effects here. Also, **smoke** can be in the set, but if it is present, the correct inference will not be generated. This possibility is not excluded, but the point here is that (30) is allowed and can be used to generate the desired scalar implicature.

- (31) Bill went for a run. He (also) didn't smoke.  
 John went for a run.  
 $\rightsquigarrow$  *John smoked*

The problem with (31), however, is that it cannot be explained by Trinh & Haida's (2015) atomicity constraint. Specifically, since the conjunction is not present, we can only create formal alternatives in (32) (**run** is the assertion; **smoke** is obtained by lexical substitution;  $\neg$ **smoke** is obtained by substituting the salient constituent 'didn't smoke').

- (32)  $F(31) = \{ \mathbf{run}, \mathbf{smoke}, \neg \mathbf{smoke} \}$

The desired scalar implicature would obtain if the alternative  $\neg$ **smoke** is negated, but this cannot be done due to its symmetric counterpart **smoke**. And **smoke** cannot be excluded from  $C$  due to the closure condition.<sup>13</sup>

One might wonder if it is possible to have multiple sentences as one alternative. If substitution can be performed on 'Bill went for a run. He didn't smoke', which is equivalent to having a conjunction between the two sentences, the necessary alternative 'John went for a run. He didn't smoke.' can be constructed. While having multiple sentences as one alternative is a logical possibility, it would remain the problem that substituting into them is exactly what the atomicity constraint prohibits. Therefore, we do not see how the conjunctions-less variant of Trinh & Haida's (2015) case can be accounted for within the structural approach with the atomicity constraint.

## 2.2 Over and under-generation problems with adjectives

We furthermore show that while Trinh & Haida's (2015) atomicity constraint was able to solve the problem of indirect scalar implicatures like (25a), it runs into a conundrum with similar cases generated by adjectives like *full* under negation. Consider the following example, for instance.

- (33) The glass isn't full.  
 a.  $\rightsquigarrow$  *The glass is not empty/is a bit filled*  
 b.  $\not\rightsquigarrow$  *The glass is empty*

<sup>13</sup> Notice that, as we mentioned above, Fox & Katzir (2011) and Trinh & Haida (2015) allow for the possibility of ignoring contextually salient constituents. Would this help in any way here? It is easy to see that it would not. In fact, it would actually make things worse, because if the salient constituent 'didn't smoke' is ignored, we will end up having the following set of alternatives:  $C = \{ \mathbf{run}, \mathbf{smoke} \}$ . From this set and the assertion we should conclude that John didn't smoke, which is the opposite of what we want to obtain.

This sentence has a robust inference that the glass is not empty. Moreover, and symmetrically, it does not appear to implicate that the glass is empty.<sup>14</sup>

Trinh & Haida (2015), however, predict exactly the opposite here. That is, they predict, at least when their proposal is taken at face value, that the sentence should be able to have a scalar implicature in (33b), and not the one in (33a).

Starting from the second problem, there is the question of how to predict the actually attested inference in (33a). That is, the question is what is the alternative that negated give rise to the inference in (33a). One possibility might be to assume that lexical replacement targets the silent positive morpheme POS widely postulated for positive forms of adjectives (Bartsch & Vennemann 1975, Cresswell 1976, von Stechow 1984, Kennedy 1999; but see Klein 1980, 1991, Doetjes, Constantinescu & Součková 2011 for different views).

(34) [ the glass isn't [ POS full ]]

The main function of POS is to introduce the standard of fullness in the context, and on the hypothesis that it can be replaced with other gradable modifiers, the sentence can get stronger meanings that can be negated by EXH. Suppose that POS is replaced by 'half', '1/3', 1% and other lexical items. Then, the negation of any of these alternatives could give us something that resembles the inference above (i.e.  $\neg\neg$ **half full**).

This would solve the under generation problem for Trinh & Haida (2015), but there are reasons to believe that this idea cannot be the whole solution, at least as it is. For one thing, the robustness of the scalar implicature dwindles considerably with other gradable adjectives. For example, compared to (33) above, similar scalar inferences cannot be drawn from the following sentences.

- (35) a. The window is not open.  
 $\not\rightarrow$  *The window is not closed.*  
 b. John is not tall.  
 $\not\rightarrow$  *John is not small.*  
 c. This neighbourhood is not safe.  
 $\not\rightarrow$  *This neighbourhood is not dangerous.*

<sup>14</sup> How can we be sure that (33b) is absent, given that it is actually compatible with the literal meaning of (33)? One argument comes from Hurford's constraint (see Chierchia et al. 2012 among many others). The idea is constructing a sentence where the second disjunct entails the first unless the first disjunct can have the inference that we are investigating. Given these assumptions, the following contrast indicates that the inference is not there.

- (i) a. ??Either the glass isn't full or it is partially filled.  
 b. Either the glass is empty or it is partially filled.

If the replacement of POS with other gradable modifiers derives (33a) for (33), it should, everything being equal, generate these scalar implicatures.

Regardless of how the under-generation problem above is solved, Trinh & Haida's (2015) importantly also overgenerates for cases like (33). That is, it predicts the inference in (33b) because of the alternative  $\neg$ **empty** obtained by simple lexical substitution of *full* and *empty*. Of course, this inference would be correctly blocked if the alternative **empty** was available, but given the atomicity constraint, **empty** cannot be in the formal alternatives. i.e., there is no way to create **empty** out of  $\neg$ **empty** without violating the atomicity constraint. Notice that this is precisely what gave Trinh & Haida (2015) the solution for the earlier examples (15a) and (19) and now creates a problem here with the case in (33). Fox & Katzir (2011), on the other hand, do not have this problem, but, as we have seen, they fail to account for (15a) and (19), as explained above. These observations are, therefore, connected in that Trinh & Haida (2015) solution for one creates a problem for the other. In other words, the atomicity constraint appears to be only a partial solution of the problem with indirect scalar implicatures.

### 2.3 Section summary

To summarise, Trinh & Haida's (2015) atomicity constraint has two major issues. One problem comes from a variant of the original problem without conjunction. Here, due to the lack of conjunction, the alternative **run**  $\wedge$   $\neg$ **smoke** that is necessary to derive the scalar implicature cannot be in the substitution source. The other problem has to do with the indirect scalar implicatures of gradable adjectives like *full*. Here, the atomicity constraint backfires as it prevents the symmetric alternative **empty** to be in the substitution source. Consequently, the wrong scalar implicature is generated by the alternative  $\neg$ **empty** that the glass is empty. Therefore, Trinh & Haida's (2015) proposal solves the original problem of indirect scalar implicatures of cases like (15a) and (19) but it appears unable to deal with indirect scalar implicatures in the general case.

In sum, the problem of indirect scalar implicatures for the structural approach to alternatives is not solved. In a general sense, this problem could be characterised as arising from the central assumption of the theory that structurally simpler alternatives always count. That is, the structural approach capitalises on the difference in structural complexity between 'some but not all' and 'all' to solve the original symmetry problem, but the same solution does not work for the case of indirect scalar implicatures involving **some** and  $\neg$ **some** and other similar pairs of symmetric alternatives where the offending alternative is structurally simpler.

At this point, let us discuss an alternative route that one might consider. We mentioned earlier that a solution to the problem with indirect scalar implicatures

could be going back to only negating strictly stronger alternatives and we also pointed out some problems that this solution would have. A more sophisticated version along those lines would be to still exploit the fact that the two symmetric alternatives **some** and  $\neg$ **some** differ in their relation to the assertion (i.e., the latter but not the former entails the assertion) while, however, allowing non-weaker alternatives in general. In other words, the idea would be to keep the definition of EXH as it is, but to tinker with the conditions on contextual restriction in (12) in such a way that when there are symmetric alternatives, where one entails the assertion and the other does not, then context can disregard the latter and keep the former in the set of alternatives. In other words, we would be allowing contextual restriction to distinguish between alternatives that are strictly stronger versus logically independent one.

There are, however, various problems with this option too, as far as we can see. First, there is the case from Trinh & Haida (2015) in (19) above where the problematic symmetric alternatives (i.e., **run**  $\wedge$  **smoke** and **run**  $\wedge$   $\neg$  **smoke**) both entail the assertion. Therefore, the modification of contextual restriction just considered would not be able to distinguish between them.

Second, one can construct cases in which there are symmetric alternatives in the set of formal alternatives and neither of them entail the assertion but still a reading with the corresponding implicature can be constructed. Consider the following variant of the example in (6) above:

- (36) *John and Bill were trying to take it easy with alcohol at the party*  
 John didn't drink wine. What about Bill?  
 He didn't drink beer.  
 $\rightsquigarrow$  *Bill drank wine*

It appears that (36) can have the implicature that Bill drank wine, despite the fact that the set of formal alternatives contain both the alternative  $\neg$ **wine** and the symmetric one **wine**, both of which do not entail the assertion, so again the modified version of contextual restriction would not be able to distinguish between them.

In the next section, we will discuss two other related problems that illustrate the general difficulty of deriving the correct set of relevant alternatives under the structural approach, independently of the atomicity constraint.

### 3 Are There Just Enough Lexical Alternatives?

#### 3.1 Too many lexical alternatives

In the original symmetry problem created by 'some but not all,' the solution under the structural approach to alternatives crucially relies on what is and is not lexicalised. In particular, it is important there is no constituent of the same or less structural

complexity as ‘some’ and ‘all’, which means ‘some but not all’ in the lexicon.

Swanson (2010), however, points out that once we move to a different domain, there are examples of what appear to be symmetric alternatives of the same structural complexity. He raises the following examples where the scalar items are *permitted*, *possibly*, and *sometimes*.

- (37) a. Going to confession is permitted.  
 b.  $\rightsquigarrow$  Going to confession is optional.  
 c.  $\not\rightarrow$  Going to confession is required.
- (38) a. The statue is possibly identical to the clay.  
 b.  $\rightsquigarrow$  The statue is contingently identical to the clay.  
 c.  $\not\rightarrow$  The statue is necessarily identical to the clay.
- (39) a. The heater sometimes squeaks.  
 b.  $\rightsquigarrow$  The heater intermittently squeaks.  
 c.  $\rightsquigarrow$  The heater occasionally squeaks.  
 d.  $\not\rightarrow$  The heater constantly squeaks.

These examples give rise to a symmetry problem, as indicated in the (c)-examples above. And these versions of the symmetry problem cannot be dealt with by Fox & Katzir’s (2011) or Trinh & Haida’s (2015) structural approach without further ado.

One could try to supplement the theory with a constraint that excludes the problematic lexical items in some principled way, e.g., by resorting to their relative low frequency. This, however, appears a non-trivial move and would force one to give up on a uniform account of the symmetry problem. In particular, the problem of indirect scalar implicatures is in a way a variant of the present problem in the sense that in both cases, there are too many formal alternatives to derive the correct inference. Thus, ideally the same constraint should take care of both cases, but it is unclear how a constraint about frequency could distinguish between symmetric alternatives like **some** and **–some**.

### 3.2 Too few lexical alternatives?

In this subsection, we discuss a potential problem of under-generation where it is not clear that the needed formal alternative can be generated under the assumptions of the structural approach to alternatives. For instance, in Japanese, deontic possibility and necessity are expressed by structurally distinct constructions, e.g. (40) and (41), respectively.

- (40) John-wa ki-te yoi.  
 John-TOP come-GERUND ok

‘John is allowed to come.’

- (41) a. John-wa ko-naku-te-wa nara/ike-nai.  
John-TOP come-NEG-GERUND-TOP be/go-NEG  
‘John must come.’  
b. John-wa kuru hitsuyoo-ga aru.  
John-TOP come necessity-NOM exist  
‘John needs to come.’

Despite this structural difference, (40) has the same scalar implicature as the English translation, i.e. that John is not required to come. However, it is not at all clear how (41) could be generated simply by lexical substitution from (40).

A possible response to this might be to assume that there actually is a grammatical alternative to (40) that expresses deontic necessity but is made unacceptable and practically unusable for independent reasons, to which computation of scalar implicatures is somehow oblivious to.<sup>15</sup> Then, the desired scalar implicature could be generated based on this grammatical but unacceptable sentence. However, a solution like this commits one to non-trivial assumptions about the theory of lexicon and acquisition of lexical items.<sup>16</sup>

Notice that analogous cases of the Japanese example above can also be constructed with English epistemic modal ‘might’, as in (42).

- (42) John might go to Dakar.

This sentence has an implicature that it is not necessary that John goes to Dakar. However, (43) cannot be an alternative to ‘might’ as it is clearly more complex.

- (43) It is necessary that John goes to Dakar.

There is of course an equally complex potential alternative to (42), involving replacement of ‘might’ for ‘must.’ The problem is that (44) does not have an epistemic reading (for most speakers).

- (44) John must go to Dakar.

Moreover, there is a sense that (42) has a reading which implicates something stronger than the negation of (43), namely that it is unlikely that John goes to Dakar. But again, since English seems to lack an item of the same category as ‘might’ meaning ‘probably’, it is not clear how the crucial alternative can be constructed with existing lexical items (‘should’ might be the lexical item we are looking for,

<sup>15</sup> Thanks to Andreas Haida (p.c.) for suggesting a possibility along these lines, and related discussion.

<sup>16</sup> For relevant discuss see Schlenker 2008, who considers the case of potential alternatives that are not even grammatical, but that nonetheless appear to be used for the computation of implicatures.

but again, for most speakers, it cannot have the relevant epistemic reading). Again, as in the case of the Japanese example above, one could assume that the epistemic reading of (44) was blocked by some constraint independent of computation of scalar implicatures, and (44) under the epistemic reading was a perfectly legitimate alternative, but it is not immediately clear what that constraint would look like.

#### 4 Concluding Remarks

The structural approach to alternatives advocated by Katzir (2007) and Fox & Katzir (2011) is one of the few systematic accounts of the symmetry problem that are available in the current literature. However, we argued that while it successfully accounts for the original version of the symmetry problem (and other related cases), it is incapable of dealing with variants of the original problematic examples. In particular, we have discussed three problems for the structural approach: (i) the problem of indirect scalar implicatures (Romoli 2013, Trinh & Haida 2015), (ii) the problem of too many lexical alternatives (Swanson 2010), and (iii) the problem of too few lexical alternatives. We claimed that Trinh & Haida's (2015) atomicity constraint does not constitute a general solution to the first problem, although it accounts for specific cases that have been previously raised, and that the two other problems remain regardless of the assumption of the atomicity constraint.

While the cases above of course are not enough to relinquish hope for the structural approach to alternatives, we do think that they cast doubt on its central tenets. Recall that the core idea of the structural approach to alternatives is to capitalise on the difference in structural complexity between the symmetric alternatives such that the offending alternative is structurally more complex. While this works well for the original example of the symmetry problem involving symmetric alternatives like 'all' and 'some but not all', the crucial imbalance in the structural complexity appears to be an accidental property of these examples, as it disappears as soon as we move to others. The three issues we discussed in the present paper all stem from such examples. It is of course possible that constraints like Trinh & Haida's (2015) atomicity constraint could be formulated in such a way as to ultimately save the structural approach from the three issues above, but it is presently unclear to us how this can be done.

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