

Hierarchical structure and local contexts¹

Jacopo ROMOLI —*Ulster University*

Matthew MANDELKERN —*Massachusetts Institute of Technology*

Abstract. In this paper, we use antecedent-final conditionals to formulate two problems for parsing-based theories of presupposition projection and triviality of the kind given in Schlenker 2009. We show that parsing-based theories go wrong when it comes to antecedent-final conditionals. These theories predict that presuppositions triggered in the antecedent of antecedent-final conditionals will be filtered (i.e. will not project) if the negation of the consequent entails the presupposition. But this is wrong: *John isn't in Paris, if he regrets being in France* intuitively presupposes that John is in France, contrary to this prediction. Likewise, parsing-based approaches to triviality predict that material entailed by the negation of the consequent will be redundant in the antecedent of the conditional. But this is wrong: *John isn't in Paris, if he's in France and Mary is with him* is intuitively felicitous, contrary to these predictions. Importantly, given that the material in question appears in sentence-final position in antecedent-final conditionals, both incremental (left-to-right) and symmetric versions of such theories make the same problematic predictions here. In Mandelkern and Romoli 2017, we discuss one solution to this problem, given within a broadly parsing-based pragmatic approach. In this paper, we explore how attention to the role of hierarchical structure in the calculation of local contexts can provide an alternative solution to our problem.

Keywords: presuppositions, presupposition projection, conditionals, parsing, linear order, hierarchical order, local context, triviality, incrementality.

1. Introduction

Schlenker (2008, 2009) has recently questioned the explanatory power of traditional dynamic approaches to presupposition projection,² posing an explanatory challenge for any theory of presupposition projection:³

Explanatory Challenge for Presupposition Projection:

Find an algorithm that predicts how any operator transmits presuppositions once its syntax and its classical semantics have been specified. (Schlenker 2009)

This challenge has sparked a debate which has led to a variety of new theories, both static (Schlenker 2009; George 2008; Fox 2008, 2012; Chemla 2010) and dynamic (Chierchia 2009; Rothschild 2008, 2011).

¹For invaluable discussion and feedback, we thank Danny Fox, Thony Gillies, Clemens Mayr, Eliot Michaelson, Daniel Rothschild, Philippe Schlenker, Benjamin Spector, and Yasu Sudo; audiences at ENS, UCL, and *Sinn und Bedeutung* 21; and several anonymous reviewers for *Sinn und Bedeutung* and *Semantics & Pragmatics*.

²This paper is a companion of Mandelkern and Romoli 2017, which explores the same puzzle but provides a different solution to it. As such, this paper shares parts of the introduction and set-up as that paper.

³Building on previous observations by Soames (1989) and Heim (1990). For traditional dynamic approaches, see Karttunen 1974; Heim 1983; Beaver 2001 among others.

One aspect of this debate is whether the algorithm for predicting presupposition projection should be based on parsing, a process which takes as input a string of linguistic items; or on the compositional calculation of meanings, a process which takes as input a syntactic structure. This debate is important because, in turn, it relates to the more general question whether presupposition calculation should be thought of as a pragmatic post-compositional phenomenon, in the sense of Chierchia et al. 2012, or as part of compositional semantics, as in the more traditional dynamic approaches.

In this paper, we will discuss sentences in which presuppositions are triggered in the antecedent of an antecedent-final conditional. We will argue that these cases present a challenge to parsing-based accounts of presupposition projection, as well as to theories of triviality that build on those accounts. We will focus in particular on the predictions of Schlenker (2009), who uses a parsing-based approach to reconstruct the notion of a local context.⁴

To briefly sketch the problem: the parsing-based approaches to presupposition projection which we will consider come in both symmetric and asymmetric versions. Both versions predict that presuppositions triggered in the antecedent of antecedent-final conditionals will be filtered (i.e. will not project) if the negation of the consequent entails the presupposition. But this is the wrong prediction; for instance, (1) presupposes that John is in France, contrary to this prediction.

(1) John isn't in Paris, if he regrets being in France.

Likewise, parsing-based approaches to triviality predict that material entailed by the negation of the consequent of an antecedent-final conditional will be redundant in the antecedent of the conditional. But, again, this is wrong; for instance, (2) is felicitous, contrary to these predictions.

(2) John isn't in Paris, if he's in France and Mary is with him.

In Mandelkern and Romoli 2017, we laid out a solution which allows us to maintain a parsing-based pragmatic approach with the caveat that, in calculating local contexts, we take into account material presupposed by the surrounding strings; we show that, together with a semantics for the conditional which assumes that it presupposes the antecedent to be compatible with the context set, this approach avoids the present problem. This approach requires a substantial shift in the formulation of the symmetric algorithm for calculating local contexts, however.

In this paper, we will take these puzzles in a different direction. In particular, we explore whether taking account of hierarchical structure in calculating local contexts provides an alternate solution to our problems. We will discuss two ways this might go. The first derives local contexts from an algorithm much like Schlenker's, but which is built on hierarchical structures rather than strings. The second builds on more traditional approaches in dynamic semantics,

⁴As we discuss in Mandelkern and Romoli 2017, however, the problems extend to other parsing-based accounts, including those which make use of a trivalent valuation instead of local contexts (e.g. Fox 2008, 2012) as well as pragmatic parsing-based theories like Schlenker 2008.

but tries to solve the explanatory problem for those approaches by augmenting them with a hierarchical constraint based Chierchia 2009. Our discussion will be somewhat inconclusive: we believe that both approaches have merits which make them worth careful exploration, but both also face substantial challenges.

The remainder of the paper is organized as follows. In the rest of this introduction, we introduce Schlenker (2009)'s algorithm for computing local contexts. In Section 2, we lay out the problem for presupposition projection from antecedent-final conditionals, and in Section 3, the problem for triviality. In Section 4, we discuss our first pass at a hierarchical approach to local contexts, building on Schlenker's system. In Section 5, we discuss our second pass at a hierarchical approach, fleshing out suggestions in Chierchia 2009. We conclude in Section 5.

1.1. A parsing-based theory of local contexts and presupposition projection

Schlenker (2009) addresses the explanatory challenge for presupposition projection by using a parsing-based algorithm to reconstruct the notion of a local context in a static, bivalent semantics.⁵ In this section, we summarize Schlenker's theory of local contexts and presupposition projection; those familiar with the theory should skip to the next section.

The basic intuition motivating Schlenker, which is similar to the intuition motivating trivalent theories of presuppositions (Peters 1979; Beaver and Kraemer 2001; George 2008; Fox 2008, 2012), is that as we evaluate a sentence against some contextual information, we try to minimize our effort by evaluating the sentence only in those worlds of the context that “matter” for the evaluation. Further, we assume (at least initially) that the interpreter evaluates expressions of a sentence proceeding left-to-right. Before evaluating an expression, the interpreter will choose the smallest domain she needs to take into consideration in evaluating such expression. This smallest domain is the local context for the expression.

Thus, for example, as we evaluate a conditional like *If A then B_p* (where B_p is a sentence B which presupposes $\llbracket P \rrbracket$), as we proceed left-to-right, we will evaluate the consequent only in those worlds of the context in which the antecedent is true.⁶ This is because we know that in those worlds in which the antecedent is false, the sentence as a whole is true irrespective of the value of the consequent, and thus we can ignore those worlds (assuming for the moment that *If...then* expresses the material conditional; we revisit this assumption below). But we cannot ignore any worlds where $\llbracket A \rrbracket$ is true, since we must check whether the consequent is true at those worlds to see whether the sentence as a whole is true. This means that the local context for B in *If A then B_p* is $C \cap \llbracket A \rrbracket$.

⁵Schlenker's approach is parsing-based in the sense we gave above: its input is a string, rather than a syntactic structure. We remain neutral on the connection of a theory like his to theories of parsing in general.

⁶We use sans serif capital letters as sentence variables, and italics to set off a linguistic example in running text. We move freely between talking of presuppositions as sentences and as propositions. Where P is a linguistic item, $\llbracket P \rrbracket^c$ is the meaning (intension) of P at context C (a non-empty set of possible worlds); we often omit reference to the context for readability. We use 'C' throughout to refer to the global context, and sometimes use 'C' as a corresponding linguistic item whose intension is the global context.

We can then formulate a theory of presupposition in this framework as follows: we say that a sentence S is assertable in a context C only if, for every expression B_p in S , $\llbracket P \rrbracket$ is entailed by B_p 's local context in S . We then say that a sentence presupposes anything that is entailed by every context where it can be asserted. This means that the predicted presupposition of *If A then B_p* is $A \rightarrow P$: in other words, *If A then B_p* is assertable at C only if $A \rightarrow P$ holds at every world in C .⁷ This approach correctly predicts that a sentence like (4) presupposes only the tautology that if John used to smoke he used to smoke:

(3) If John used to smoke, he stopped smoking.

But—as Schlenker (2008, 2009) and Chierchia (2009), building on Heim 1990; Soames 1979 and others discuss—antecedent-final conditionals pose a problem for the asymmetry encoded in this algorithm. (4), like (3), appears to have only a trivial presupposition, but this is not predicted by the incremental left-to-right algorithm, which only considers material to the left of the presupposition trigger.

(4) John stopped smoking, if he used to.

Intuitively, we would like material on the right of the presupposition trigger to count in this case. In response to these data, Schlenker (2009) proposes a symmetric version of his algorithm, which works on the entire sentence, rather than proceeding left-to-right: it considers both material on the left and the right of the expression to be evaluated. The result is that the symmetric local context for B in a conditional with the form B_p , *if A* is $C \cap \llbracket A \rrbracket$; thus we predict that a conditional like (4) has no presupposition, as desired.

Schlenker makes these intuitive ideas precise as follows. First, the incremental, left-to-right version:

Definition 1.1. Local Contexts, Incremental Version:⁸

The *incremental local context* of expression E in syntactic environment a_b and global context C is the strongest $\llbracket Y \rrbracket$ s.t. for all sentences D and good finals b' , $a(Y \wedge D)b' \leftrightarrow_c aDb'$.

In addition to this incremental algorithm, Schlenker (2009) also defines a symmetric version,

⁷With \rightarrow standing for the material conditional. Notice that for some cases, the predicted conditional presuppositions of conditionals appears too weak. This is the so-called Proviso Problem (Geurts 1996 and much subsequent work; see Schlenker 2011 among others for recent discussion). This problem is orthogonal to the one we discuss here, however. Although the problem we raise for presupposition projection, like the Proviso Problem, stems from a gap between the observed projection and what is predicted, there is a crucial structural difference: in Proviso cases, the gap is between observed presuppositions with the form $\llbracket P \rrbracket$, and predicted presuppositions with the form $\llbracket A \rightarrow P \rrbracket$. It is possible that a principled story can be told about how we move from the latter to the former (and indeed just such a story has been told in the literature; see Mandelkern 2016 for citations and criticism). By contrast, in the cases we raise here, the gap is between observed presuppositions with the form $\llbracket P \rrbracket$, and a predicted trivial presupposition—i.e. a presupposition of \top . It is much harder in this case to see how a strengthening story would help: there is no obvious principled way to get from \top to $\llbracket P \rrbracket$.

⁸We restrict our attention here to a propositional fragment; for a general version, see Schlenker 2009. The good finals of an expression are all strings that can grammatically follow that expression. ' \leftrightarrow_c ' is material equivalence *modulo* a context C .

which applies as a dispreferred rescue strategy:

Definition 1.2. Local Contexts, Symmetric Version:⁹

The *symmetric local context* of expression E in syntactic environment a_b and global context C is the strongest $\llbracket Y \rrbracket$ s.t. for all sentences D: $\mathbf{a}(Y \wedge D)\mathbf{b} \leftrightarrow_c \mathbf{aDb}$, where **a** and **b** are derived from a and b by removing any presupposition material.

This symmetric algorithm is like the incremental version except for two features. First, it takes into account all material in the sentence, regardless of whether it precedes or follows the expression to be evaluated: this is what makes it symmetric. Second, it ignores presuppositions in the surrounding material. The reason for this second feature is that, as Rothschild (2008) and Beaver (2008) point out, without it, the symmetric algorithm incorrectly predicts that on a symmetric parse, presuppositions can cancel each other out. Thus we would predict e.g. that a sentence like (5), with the form A_p and B_p , should not presuppose p .

(5) The King of France is bald and the King of France is tall.

But this is wrong; to see that (5) presupposes that there is a king of France, note that this inference projects when (5) is embedded in the antecedent of a conditional, as in (6):

(6) If the King of France is bald and the King of France is tall, there will be no diplomatic incident.

Analogous data can be generated with disjunction (see Rothschild 2008). This problem is avoided by the algorithm given above, according to which we ignore the presuppositional material of a and b when calculating the local context of the constituent between a and b.

Notice that if we are evaluating an expression D which appears sentence-final, the symmetric and incremental local context of D are identical. This is important for our purposes: it follows that for the data we are concerned with in this paper—the antecedents of antecedent-final conditionals—the incremental and symmetric versions of the algorithm will make the same predictions.

2. The problem for presupposition projection

To work up to our puzzle, consider first a conditional with a presupposition trigger in the antecedent, as in (7).

(7) If A_p then B.

Here the incremental and symmetric algorithms for calculating local contexts make different predictions, since the trigger appears sentence-initial. The incremental algorithm predicts that

⁹This formulation assumes that it is possible to “delete” a sentence’s presuppositions from the sentence. It is not obvious to us that this is possible, but we set aside this issue here. See Mandelkern and Romoli 2017 for further discussion.

(7) presupposes P . The symmetric one, on the other hand, takes into consideration the material following A_p in evaluating it. $[[B]]$ -worlds would make the whole sentence true regardless of the value of the antecedent; thus we only need to consider $[[\neg B]]$ -worlds in evaluating A_p .¹⁰ In particular we must consider every $[[\neg B]]$ -world in the context. Thus the symmetric local context of A_p in (7) is $C \cap [[\neg B]]$, and so the predicted presupposition of the symmetric algorithm is $\neg B \rightarrow P$.

Schlenker (2009); Chemla and Schlenker (2012) and Rothschild (2011) discuss whether the prediction of the symmetric algorithm for (7) is correct. But this discussion is complicated by the fact that the symmetric algorithm is taken to be a dispreferred interpretive strategy, making it hard to see how to evaluate this prediction.

We can avoid this complication, however, by considering the antecedent-final counterpart of (7), in (8).

(8) B , if A_p .

Here the incremental and the symmetric algorithms make the same predictions, since in both versions of the algorithm the material on the left of the trigger is taken into account, and there is no material to the right of the trigger in this case. This allows us to avoid difficult questions about the relation between an incremental and symmetric algorithm,¹¹ and directly evaluate the plausibility of a parsing-based algorithm of either form.

Both algorithms predict that at the point at which we process A , we only need to consider $[[\neg B]]$ -worlds of C , because $[[B]]$ -worlds would make the sentence true regardless of the value of the antecedent. Therefore the incremental and symmetric local context for A in (8) is $C \cap [[\neg B]]$. Thus the predicted presupposition of (8), for both the incremental and symmetric approach, is $\neg B \rightarrow P$.

But this prediction is problematic. It follows from this prediction that if the negation of the consequent of an antecedent-final conditional entails the presupposition of the antecedent, the sentence will be presuppositionless. Schematically, a case like (9), where $[[P^+]]$ entails $[[P]]$, is thus predicted to presuppose nothing.

(9) $\neg P^+$, if A_p .

This prediction, however, does not match intuitions. To see this, consider first the conditionals in (10a), (11a), and (12a). They appear to presuppose that John is in France, that he is sick, and that he is a linguist, respectively, as predicted by the incremental parsing approach.

- (10) a. If John regrets being in France, he isn't in Paris.
 b. John isn't in Paris, if he regrets being in France.

¹⁰We sometimes use ' \neg ' and other logical connectives as abbreviations for the corresponding natural language connectives. We leave most of our derivations of local contexts at the present level of informality; the reader can check them for herself, or refer to Schlenker 2009.

¹¹On which see Schlenker 2008, 2009; Chemla and Schlenker 2012 and Rothschild 2011.

- (11) a. If John's wife is happy that he is sick, he doesn't have cancer.
 b. John doesn't have cancer, if his wife is happy that he is sick.
- (12) a. If John is happy he is a linguist, he isn't a semanticist.
 b. John isn't a semanticist, if he is happy that he is a linguist.

Consider now the corresponding antecedent-final conditionals in (10b), (11b), and (12b), which have the form of (9). Intuitively these have the same presuppositions as the antecedent-initial versions. The problem is that the symmetric and incremental versions of the algorithm both predict that (10b), (11b), and (12b) have no presuppositions.¹²

Both the symmetric and incremental parsing-based algorithms given in Schlenker 2009 thus apparently make the wrong predictions for antecedent-final conditionals with a presupposition trigger in the antecedent: they predict that, when the conditional has the form of (9), its presupposition will be filtered, whereas the presupposition in fact projects.

3. The problem with triviality

The parsing-based theory of local contexts can be straightforwardly extended to a theory which predicts when a sentence strikes us as trivial or redundant. We show in this section that the problem raised in the last section extends to this theory.

Reconstructing the notion of local context allows Schlenker (2009) to connect his theory to a general theory of triviality, a theory with roots in Stalnaker 1978 (see also Singh 2007; Fox 2008; Chierchia 2009; Mayr and Romoli 2016 among others).¹³ Given the account of local contexts sketched above, we say that a sentence *S* is infelicitous if, for any part *E* of *S*, $\llbracket E \rrbracket$ is entailed or contradicted by its local context.

This approach correctly predicts that a sentence like (13) should be infelicitous, since it has a part, namely *he is in France*, whose content is entailed in its local context (whether we calculate it incrementally or symmetrically):

- (13) #If John is in Paris, he is in France and Mary is with him.

Similarly, this approach predicts that (14) should not be assertable, given that *he is in Paris* is contradictory in its local context.

- (14) #If John isn't in France, he is in Paris and Mary is with him.

So far so good. Now consider the predictions of the parsing-based algorithm for antecedent-final conditionals. Recall in particular that the local context of the antecedent of an antecedent-

¹²In other words, that all three have trivial presuppositions: respectively, that if John is in Paris, then he is in France; that if John has cancer, then he is sick; and that if John is a semanticist, then he is a linguist.

¹³A theory of triviality can also be formulated in terms of equivalence to simplifications of the sentence, in the sense of Katzir 2007, to which one can add an incremental component (see Mayr and Romoli 2016; Meyer 2013 and Katzir and Singh 2013 for discussion). The problems discussed here extend to this approach as well.

final conditional like *B, if A* is predicted by both the incremental and symmetric algorithms to be $C \cap \llbracket \neg B \rrbracket$. The theory of triviality under discussion thus predicts that if $\llbracket A \rrbracket$ is entailed or contradicted by $C \cap \llbracket \neg B \rrbracket$, the sentence should not be assertable. Both the symmetric and incremental algorithms thus predict that a sentence with the form

(15) $\neg P^+$, if P and Q.

will be infelicitous, since P will be redundant. But this is wrong. To see this, consider first the antecedent-initial conditionals in (16a) and (17a).

(16) a. If John is in France and Mary is with him, then he's not in Paris.
b. John isn't in Paris, if he is in France and Mary is with him.

(17) a. If John is sick and his wife is happy that he is sick, then he doesn't have cancer.
b. John doesn't have cancer, if he is sick and his wife is happy that he is sick.

We judge these conditionals to be perfectly felicitous. Now consider the antecedent-final versions, in (16b) and (17b). We judge these versions to be equally felicitous. However, the parsing-based theory of triviality (on both its incremental and symmetric versions) wrongly predicts that the antecedent-final versions will be infelicitous, since both have material that is locally redundant (*he is in France* and *he is sick*, respectively).

4. Hierarchical transparency

Antecedent-final conditionals thus present a puzzle for a parsing-based approach to local contexts. In Mandelkern and Romoli 2017, we present a solution to this puzzle which stays largely within the bounds of the parsing-based framework. Here we will briefly explore two alternate solutions, both of which reject Schlenker's parsing-based approach in favor of approaches which track hierarchical structure.

The first solution, which we call a *hierarchical transparency* approach, retains the basic idea of Schlenker's algorithm: namely, that the local context for an expression in a certain environment is the strongest meaning which *adds nothing* to that environment; i.e. the strongest meaning which is *transparent* in that environment. We depart from Schlenker, however, in implementing this idea with an algorithm that takes into account hierarchical structure, rather than linear order.

Before sketching the algorithm and how it might help with our case, let us quickly review some data which will provide independent evidence for the hierarchical transparency approach. The first comes from Ingason 2016, which explores triviality judgments regarding relative clauses in head-final languages, in particular Korean and Japanese. Ingason shows that triviality judgments track hierarchical structure and *not* linear order. Consider first the contrast between (18a) and (18b). (18b) is infelicitous, just as predicted by Schlenker's algorithm, since the local context for *is a man* will entail *is a man* in (18b), but not (18a).

(18) a. John met a man who is an uncle.

- b. #John met an uncle who is a man.

These sentences are in English, a head-initial language, where hierarchical structure and linear order of relative clauses correspond. It turns out that when we look at head-final languages like Korean and Japanese, however, where these come apart, judgments about triviality track hierarchical structure, and *not* linear order. Here is Ingason’s data from Korean:

- (19) a. Mary-nun [[accessi-in] sengin namca-lul] mannassta.
 Mary-TOP [[mister-ADN] adult male-ACC] met.
 ‘Mary met an adult man who is a mister/uncle.’
 b. #Mary-nun [[sengin namjcaa-in] acessi-lul] mannassta.
 Mary-TOP [[adult male-ADN] mister-ACC] met.
 ‘Mary met a mister/uncle who is an adult male.’

The second relevant data regards presupposition projection, and comes from Chung 2017. Chung notes that Korean is a SOV language, and thus that the attitude verb generally follows its complement clause in terms of linear order. If the calculation of local contexts were sensitive to linear order, then, the local contexts for the complements of attitude verbs would be given by the global context, just as for unembedded material. But this is not what happens; presuppositions rather project just as they do in English. For instance, (20) is not felt to presuppose that Mary used to smoke, contrary to what we would predict if the local context for the second attitude ascription was calculated based on linear order:

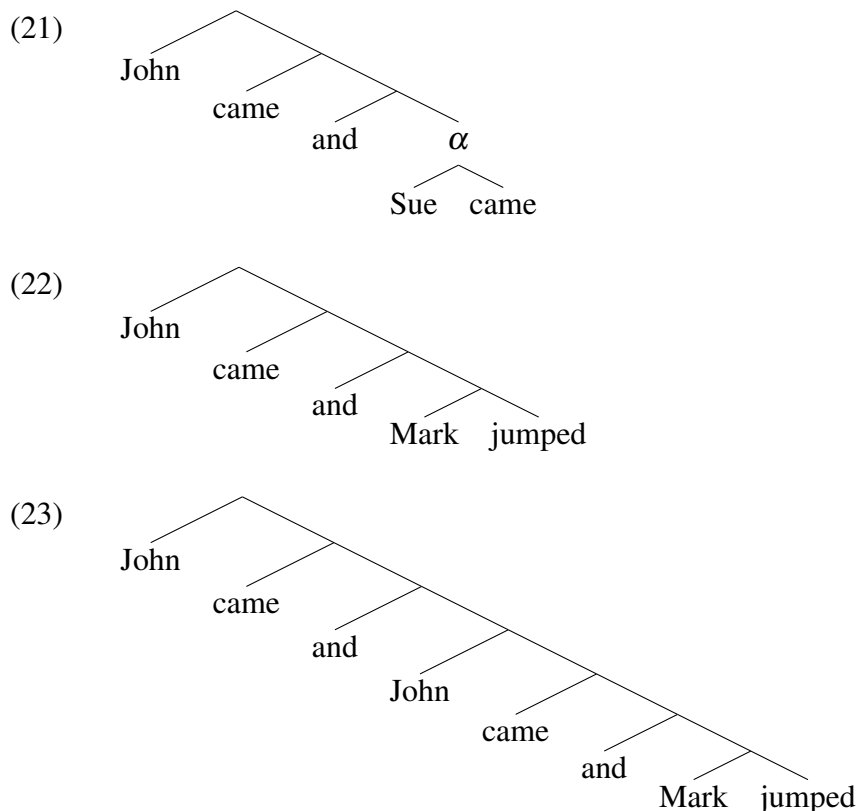
- (20) John-un Mary-ka kotunghakkyo ttay tampay-lul pi-ess-ess-tako
 John-TOP Mary-NOM high school time cigarette-ACC smoke-PERF?-PAST-COMP
 mit-ø-ko, (John-un) Mary-ka cikum-to keysokhayse tambay-lul
 believe-PRES-CONJ John-TOP Mary-NOM now-also continuously cigarette-ACC
 pi-n-tako mit-nun-ta.
 smoke-PRES-COMP believe-PRES-DECL.
 ‘John believes that Mary smoked in high school, and he believes that she continues to smoke.’

These data regarding triviality and presupposition projection suggest that our calculation of local contexts needs to track hierarchical structure, not linear order. To achieve this in a framework broadly like Schlenker’s, we will modify his algorithm so that it takes into account hierarchical structures, rather than linear order (we’ll focus only on the incremental version, since in the symmetric version, the predictions will be essentially equivalent to Schlenker’s approach). The idea is simple: to derive the local context for an expression, we look at that expression’s place in its LF, and we look at what we could add to that place in the LF, so that however the LF is completed – that is, however we fill in the material which that expression c-commands – the LF’s denotation remains the same.¹⁴

More formally, for any LF A and node α in A , let us define a *good-completion* of A at α as any

¹⁴Note that, while c-command seems like the obvious notion to advert to here, it is straightforward to vary this part of our algorithm with other syntactic notions.

well-formed LF which is identical to A except that any clause dominated or asymmetrically c-commanded by β may be replaced by new material, where β is the lowest node above α which dominates a full clause. For any sub-tree Y , let a Y -good-completion of A at α be any good completion of A at α such that α is replaced by a subtree beginning with $[Y \text{ and}]$. Thus for instance (22) is a good-completion of (21) at α , and (23) is a [John [came]]-good-completion of (21) at α .



Now we are in a position to state the hierarchical transparency algorithm. We assume now that our denotation function is defined on LFs:

Definition 4.1. Local Contexts, Hierarchical Transparency Version:

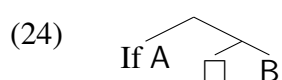
The local context of expression E at node α in LF A and global context C is the strongest $\llbracket Y \rrbracket$ s.t. for all good-completions D of A at α , and for all Y -good-completions of A at α , D^Y , $\llbracket D \rrbracket \cap C = \llbracket D^Y \rrbracket \cap C$.

The idea, again, is similar to Schlenker’s algorithm, except that the local context here is calculated by finding the strongest thing that we can add to the LF of the expression in question while preserving contextual equivalence, no matter how that LF is completed – rather than the strongest thing we can add to the linguistic string in question. Let’s note, first of all, the overlap with Schlenker’s algorithm. Assuming that conjunction has the straightforward hierarchical syntax illustrated in (21), then it is easy to verify that the local context for A in $A \text{ and } B$ in global context C is just C ; and the local context for B is $C \cap \llbracket A \rrbracket$. Likewise, the local context for A in $A \text{ or } B$ in global context C is just C ; and the local context for B is $C \cap \llbracket \neg A \rrbracket$. Likewise,

finally, the local context for *A* in *Not A* in global context *C* is just *C*. These predictions are all identical to Schlenker's.¹⁵

Things get more interesting, however, when we look at head-final or SOV languages like Korean. Assuming that the clausal part of the relative clause is *c*-commanded, but does not *c*-command, its head noun, then, in our framework, the content of its head noun will always form part of the content of the local context for the relative clause, *whatever the relative linear order of the head and the relative clause*. That is, take a sentence like *John met an uncle who is a man*.. We assume this sentence has an LF with at least the structure [*John met an uncle* [*who*₁ [*t*₁ *is a man*]]]. In this structure, *t*₁ *is a man* does not *c*-command *an uncle*. This means that in calculating the local context for *t*₁ *is a man*, we will take into account *an uncle*, and thus find that the local context for *t*₁ *is a man* entails *t*₁ *is an uncle*, and therefore *t*₁ *is a man*. Crucially, in the hierarchical transparency account – unlike in Schlenker's algorithm – this holds *whatever the linear order* of the relative clause and its head, provided that the structure is preserved. Similar considerations show that – since the complements of attitude predicates do not asymmetrically *c*-command the predicate – we predict that the local context under an attitude predicate is the set of attitude worlds, whether or not the attitude predicate precedes its complement, as in English, or follows it, as in Korean.

The hierarchical transparency approach to local contexts (or something roughly along these lines) seems to us to be the right way to preserve the explanatory and predictive virtues of Schlenker's algorithm, while respecting the fact that presupposition and triviality seem to be calculated in a way which depends on hierarchical structure, rather than linear order. But does it help with our motivating problem? This depends crucially on what we assume about the syntax of the conditional. Suppose that the antecedent of conditionals asymmetrically *c*-commands the consequent. The assumption would be that the syntax of the conditional is roughly as in (24), where \square is the conditional's (possibly covert) modal:



Then the local context for the antecedent *If A* will not entail the negation of the consequent, since the antecedent asymmetrically *c*-commands *B*, and so we will ignore that part of the LF in searching for the strongest transparent restriction for the antecedent; instead, the strongest transparent restriction will just be the global context. By contrast, the consequent *B* does not asymmetrically *c*-command the antecedent, and so in a structure like (24) there will be nothing that we ignore when calculating the strongest transparent restriction for *B*. If we assume that antecedent-final conditionals are generated from a structure like this, and simply linearized in a different way from antecedent-initial conditionals, this would solve our problem.

But this approach raises a number of serious questions. First, this approach assumes that the sister of *If* is not a full clause, in the sense relevant to our algorithm, whereas the sister of \square is. It is not clear to us how to spell that out. Second, there is binding evidence which suggests

¹⁵It is worth noting here that we can also capture symmetric filtering for connectives in this algorithm if we assume non-standard syntactic structure in those cases.

that antecedent-final conditionals are not generated from structures like (24). In particular, the infelicity of (25) suggests that the consequent of antecedent-final conditionals c-commands the subject of the antecedent, contrary to this picture (see Bhatt and Pancheva 2006):

(25) He_[1*/2] isn't at home, if John₁ is with Susie.

The plausibility of the hierarchical transparent approach will turn on whether appropriate syntactic assumptions can thus be fleshed out. This is a topic which we leave for future work. Let us note here, however, that, even if it does not solve the present problems, we might still opt for the hierarchical transparent approach on the basis of evidence of the kind discussed above, and then supplement that approach with the kind of solution to our problem given in Mandelkern and Romoli 2017.

5. Dynamic semantics

In this section we turn to the question of whether dynamic semantics provides an alternate solution to our puzzles.

5.1. Traditional dynamic semantics

A theory like Heim 1983 certainly avoids the problems sketched above. This is because in such a system, as Chemla and Schlenker (2012) put it, the 'left-right asymmetries reach down to the lexical representations of logical operators.' And once the lexical meaning of a conditional operator is stipulated, it doesn't matter whether the antecedent appears sentence-final or sentence-initial. In other words, given the way the left-right asymmetry in dynamic semantics is encoded, what matters is what is encountered first in the semantic composition, rather than in parsing. And for both the antecedent-initial and antecedent-final cases, *If* composes first with the antecedent and then with the consequent. If *If* is treated as a two-place sentential operator, then, as in Heim's system, once we define a context-change potential for *if* which makes the right predictions for an antecedent-initial conditional, it will make the same correct predictions for the antecedent-final counterpart.

There remains, however, a serious open question about this approach, since the meaning of *if* in a system like Heim 1983 is stipulated in a way that doesn't address the explanatory challenge that we summarized at the outset. We can briefly illustrate the problem as follows: there is nothing in the system that prevents us from defining a meaning for *If* which is truth-conditionally equivalent to the one Heim proposes, but which makes the wrong predictions about presupposition projection for both antecedent-initial and antecedent-final conditionals. For instance, Heim's entry for the conditional is $c[\textit{If } A, \textit{ then } B] = c \setminus c[A][\neg B]$. A truth-conditionally equivalent entry would run $c[\textit{If } A, \textit{ then } B] = c \setminus c[\neg B][A]$. But this latter entry wrongly predicts that the negation of the consequent is taken into account in evaluating the presuppositions of the antecedent.

5.2. Explanatory dynamic accounts

Constrained dynamic approaches (Rothschild 2008, 2011; Schlenker 2009; Chierchia 2009) aim to solve the explanatory problem by giving a principled way to determine CCPs for connectives. We turn to those now. The upshot is that if in addressing the explanatory challenge they make use of an ordering constraint based on parsing, they incur the same problems of the static parsing-based approaches. What is arguably needed is a way of addressing the explanatory problem which also adverts to the fact that in antecedent-initial and antecedent-final conditionals, meanings are composed in the same way. As we discuss, a development of the suggestions in Chierchia 2009 might achieve this result.

Rothschild (2008, 2011), like Schlenker, gives both a symmetric and an asymmetric algorithm; but in this case, the asymmetric algorithm is based on the structure of certain formulas which sentences get mapped to, rather than linear order. Simplifying a bit, his asymmetric approach requires that the meaning of a formula like $A \rightarrow B$ has to be such that the CCP of A is not allowed to operate on a formula that contains B . Rothschild then shows that such order constraint leads to the same predictions as Heim (1983)'s system. What is relevant here is that if both antecedent-initial and antecedent-final conditionals *If A then B* and *B, if A* are meant to be mapped to the formula $A \rightarrow B$ in his framework, then his predictions are the same for both and therefore correct. Rothschild's approach thus both makes the correct predictions in our key cases, and avoids the criticism of Heim's account. However, the solution to our cases in his approach depends on a stipulative mapping of sentences to formulas, and therefore, before resting content with this approach, we should look for some further explanation of how this mapping works, in particular a general principle which guarantees that antecedent-final and antecedent-initial conditionals will both be mapped to the same, antecedent-initial formula.

Schlenker (2009: sect. 3.2) discusses a dynamic implementation of his system. The idea is that rather to have his algorithm define directly the notion of local contexts, one could use it to 'decide' between different possible dynamic meanings of logical operators. Schlenker assumes, however, that the order of the CCPs is determined by an underlying canonical order, and thus that the CCP of a conditional is defined by applying the local context algorithm to the antecedent-initial version of a conditional sentence. This mapping is, as for Rothschild, somewhat stipulative.

Chierchia (2009) more explicitly constrains dynamic semantics by tying the dynamic meanings of connectives to the way meanings are composed in the syntax. In this way, he both addresses the explanatory problem and solves the antecedent-final problems discussed above. In particular, he proposes the following syntax-semantics principle, slightly adapted here from the original formulation, for constraining the choice between the possible dynamic meanings of logical operators.

(26) **Chierchia's order constraint:**

- a. For any function f with arguments A, B , define the meaning of f so that A 'provides' the local context of B (i.e. either the local context of B entails $\llbracket A \rrbracket$ or its negation), iff $f(A)$ f-commands B .

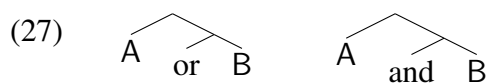
- b. If A and B are co-arguments of f , $f(A)$ f-commands B iff the first functional complex $f(A)$ containing A does not contain B . (= A is closer to f than B).

(26) provides a systematic way of choosing among dynamic meanings for functions f . Further constraints on truth-conditional adequacy then allow us to narrow down the admissible dynamic meanings (though this will not suffice to yield the correct one; we will need further constraints, perhaps along the lines given in Rothschild 2011). Crucially, this approach does not rely on a stipulative mapping of formulas, but rather on a generalization about the interface between syntax and semantics. Now, if we assume, again, that If is a two-place sentential operator which takes the antecedent of conditionals as its first argument and the consequent as its second, then it follows that the antecedent provides the local context for the consequent, but not vice versa. Since this assumption about the functional architecture of conditionals is independent of the linear order of the antecedent and consequent, this approach suffices to avoid our problems: the local context for the antecedent of a conditional, whether preposed or postposed, will be the global context.

Note that, while a syntax/semantics principle like Chierchia's solves our problem, there is no need to implement this approach in a dynamic semantics. That is, it is not an argument for dynamicity *per se*. For instance, we could make use of a similar principle to constrain a trivalent approach, though we will not explore this option here.

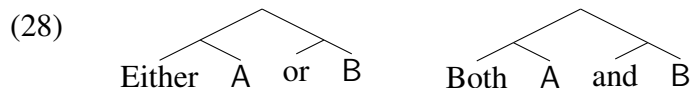
5.3. A challenge for the hierarchical-based accounts

Supplementing dynamic semantics with Chierchia's constraint yields a satisfying solution to our problem. But it raises a variety of new problems. The challenge for this hierarchical approach, as George (2008) and Chierchia (2009) discuss, comes when we turn to binary connectives like *or* and *and*. If, as is standard, we assume that these connectives form constituents with the second conjunct/disjunct, as in (27), we predict that it is the second conjunct/disjunct which provides the local context for this first one.



This would predict that in conjunctions and disjunctions the presupposition of the first conjunct/disjunct can only be filtered by the second one and that triviality would arise in the same direction. While this is a possibility (in particular for disjunction), it certainly is not the only possibility, which is what the constraint would predict given the structure in (27).

Chierchia (2009) proposes a revisionary syntactic-semantic solution, based on two ingredients. First, conjunctions and disjunctions would always contain either *both* or *either*, which can be overt or covert, and which, crucially, form a constituent with the first conjunct/disjunct, as in (28).



Second, the meaning of the two connectives is associated with *both* and *either*, respectively; *and* and *or* will be semantically vacuous. If we accept these two assumptions, the predictions of the hierarchical order account are now the expected ones: the first conjunct/disjunct can filter the presupposition of the second one, but not vice versa. This is a substantial revisionary assumption about the syntax and semantics of connectives, however; the plausibility of this approach will depend on the plausibility of this assumption.

Another challenge for this solution is to explain cases of symmetric filtering with disjunction. A possible response to data like (28) within this approach would be to claim that a disjunction can involve an ambiguity as to whether the meaning of the connective is associated with *Either* or it is associated with *Or* in a structure like (28). In the former case, disjunction would be associated with first-disjunct-to-second-disjunct filtering, in the latter with filtering in the opposite direction. The key question for this approach is whether either structure is plausible on broader syntactic considerations.

6. Conclusion

We have used antecedent-final conditionals to formulate a problem for parsing-based theories of local contexts. Those theories – both the incremental and the symmetric variants – predict that the negation of the consequent of antecedent-final conditionals will be entailed by the local context for the antecedent. Data from presupposition projection and triviality judgments, however, show that this is wrong.

In Mandelkern and Romoli 2017, we laid out one solution to this problem broadly within a parsing-based approach to local contexts. In this paper, we have explored two alternate solutions. The first builds on Schlenker’s idea that a local context is the strongest trivial restriction in a given environment. Rather than taking the environment to be a linear string of linguistic items, we explored an account which takes the environment to be an LF. The resulting theory nicely accounts for a range of data which appear to show that the calculation of local contexts must be hierarchical. It helps with our problem only under certain assumptions about the syntax of the conditional, however, assumptions which raise a number of questions which we cannot explore here.

The second builds on traditional dynamic semantic accounts along the lines of Heim 1983. As we discussed at the outset, this style of dynamic semantics has come under attack for being insufficiently explanatory. In recent years, however, more explanatory theories have been proposed which, like dynamic semantics, base the calculation of local contexts on compositional structure. We explored an account based on Chierchia 2009 which constrains possible dynamic semantic entries according to the order of functional application. This approach nicely accounts for our cases, but is only plausible if we make certain revisionary assumptions about the syntax and semantics of other connectives – assumptions which, again, raise a number of questions which we cannot explore here.

References

- Barker, C. (2008, October). Notes on presupposition and order of composition. Manuscript, NYU.
- Beaver, D. (2001). *Presupposition and Assertion in Dynamic Semantics*. Stanford University: CSLI Publications.
- Beaver, D. (2008). As brief as possible but not briefer. *Theoretical Linguistics* 34, 213–228.
- Beaver, D. and E. Krahmer (2001). A partial account of presupposition projection. *Journal of Logic, Language and Information* 10(2), 147–182.
- Bhatt, R. and R. Pancheva (2006). Conditionals. In M. Everaert and H. v. Riemsdijk (Eds.), *The Blackwell Companion to Syntax*, Volume 1, pp. 638–687. Blackwell Publishing.
- Chemla, E. (2010). Similarity: towards a unified account of scalar implicatures, free choice permission and presupposition projection. Unpublished manuscript.
- Chemla, E. and P. Schlenker (2012). Incremental vs. symmetric accounts of presupposition projection: an experimental approach. *Natural Language Semantics* 20(2), 177–226.
- Chierchia, G. (1995). *Dynamics of Meaning*. Chicago: University of Chicago Press.
- Chierchia, G. (2009, September 28). On the explanatory power of dynamic semantics. Handout from talk at Sinn und Bedeutung 14.
- Chierchia, G., D. Fox, and B. Spector (2012). The grammatical view of scalar implicatures and the relationship between semantics and pragmatics. In C. Maienborn, K. von Stechow, and P. Portner (Eds.), *Semantics: An International Handbook of Natural Language Meaning volume 3*. Berlin: Mouton de Gruyter.
- Chung, W. (2017). An evaluation-sensitive model for local context computation. Unpublished manuscript NYU.
- Fox, D. (2008). Two short notes on schlenker's theory of presupposition projection. *Theoretical Linguistics* 34(3), 237–252.
- Fox, D. (2012). Presupposition projection from quantificational sentences: Trivalence, local accommodation, and presupposition strengthening. In I. Caponigro and C. Cecchetto (Eds.), *From grammar to meaning: The spontaneous logicity of language*, pp. 201–232. Cambridge University Press.
- George, B. (2008). Presupposition repairs: a static, trivalent approach to predicting projection. Master's thesis, UCLA.
- Geurts, B. (1996). Local satisfaction guaranteed: A presupposition theory and its problems. *Linguistics and Philosophy* 19(3), 259–294.
- Heim, I. (1983). On the projection problem for presuppositions. In D. P. Flickinger (Ed.), *Proceedings of WCCFL 2*, Stanford University, Stanford, California, pp. 114–125. CSLI Publications.
- Heim, I. (1990). Presupposition projection. In Rob van der Sandt (ed.), *Reader for the Nijmegen Workshop on Presupposition, Lexical Meaning, and Discourse Processes*.
- Ingason, A. (2016). Context updates are hierarchical. *Glossa* 1(1), 1–9.
- Karttunen, L. (1974). Presupposition and linguistic context. *Theoretical Linguistics* 1, 181–194.
- Katzipir, R. (2007). Structurally-defined alternatives. *Linguistic and Philosophy* 30(6), 669–690.
- Katzipir, R. and R. Singh (2013). Hurford disjunctions: Embedded exhaustification and structural economy. In U. Etxeberria, A. Fălăuș, A. Irurtzun, and B. Leferman (Eds.), *Proceedings of*

Sinn und Bedeutung 18.

- Mandelkern, M. (2016). A note on the architecture of presupposition. *Semantics & Pragmatics* 9(13).
- Mandelkern, M. and J. Romoli (2017). Parsing and presupposition in the calculation of local context. *Semantics & Pragmatics*. in press.
- Mayr, C. and J. Romoli (2016). A puzzle for theories of redundancy. *Semantics and Pragmatics* 9(7).
- Meyer, M.-C. (2013). *Ignorance and grammar*. Ph. D. thesis, MIT.
- Peters, S. (1979). A truth-conditional formulation of Karttunen's account of presupposition. *Synthese* 40, 301–316.
- Rothschild, D. (2008). Transparency theory and its dynamic alternatives. Commentary on *Be articulate*. *Theoretical Linguistics* 34(3), 261–268.
- Rothschild, D. (2011, July). Explaining presupposition projection with dynamic semantics. *Semantics and Pragmatics* 4(3), 1–43.
- Schlenker, P. (2008). Be articulate: A pragmatic theory of presupposition projection. *Theoretical Linguistics* 34(3), 157–212.
- Schlenker, P. (2009, July). Local contexts. *Semantics and Pragmatics* 2(3), 1–78.
- Schlenker, P. (2011). The proviso problem: a note. *Natural Language Semantics* 19, 395–422.
- Singh, R. (2007). Assertability constraints and absurd assertions. Unpublished ms. MIT.
- Soames, S. (1979). A projection problem for speaker presuppositions. *Linguistic Inquiry* 10(4), 623–666.
- Soames, S. (1989). Presupposition. In D. Gabbay and F. Guenther (Eds.), *Handbook of Philosophical Logic*, Volume IV, pp. 553–616. Dordrecht: Reidel Publishing Company.
- Stalnaker, R. (1978). Assertion. *Syntax and Semantics* 9.