

# Modularity and Locality in Interpretation

by

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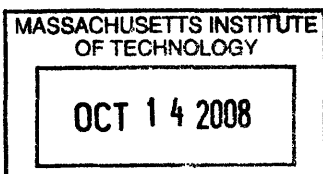
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## Abstract

This thesis will argue for four broad claims: (1) That local contexts are needed for a descriptively adequate theory of linguistic interpretation, (2) That presupposition accommodation is made with respect to a set of grammatically defined candidates, (3) That the set of accommodation candidates is derived from the same linguistic objects that are used to derive candidates for implicature (the scalar alternatives of the asserted sentence), (4) That scalar implicatures and accommodated propositions are the output of Fox's [31] procedure of innocent exclusion, modified so as to consider implicature candidates and accommodation candidates together. I argue for claim (1) in Chapter 2 by arguing that Heim's principle of *Maximize Presupposition!* should be checked in local contexts (Local MP). In Chapter 3, I use Local MP to account for an array of blocking effects. We will see that Local MP can help to shed light on the semantics of *only*, counterfactual conditionals, and focus interpretation, as well as highlighting the importance of dynamically changing assignment functions in a theory of interpretation. I argue for claims (2)-(4) in Chapters 4 and 5 by attempting to address the proviso problem (Geurts [43]), as well as a new puzzle for the theory of implicature that arises in the study of attitude ascriptions.

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Before classes started in first year, Donca Steriade seemed to realize that two of the members of ling-03 were likely to be slower than the rest. So she sent them an email, suggesting they read the first four chapters of Kenstowicz and Kisseberth before classes begin. One of the recipients was yours truly. The other was Roni Katzir. I was disappointed to learn that, the name notwithstanding, the referent of 'Roni' was actually a 'he,' a he who was bald, hawkish, and had a bigger chip on his shoulder than the one I came packaged with. Well, we met one night to talk about the reading and neither of us had read a page. So we just talked the night away. And so it would be, for the next five years. They changed my life.

It takes a village, they say. I was lucky to have been raised by two. I belong to a clan of sorts, seven families on my father's side, five on my mother's. Even though they rather frequently 'pick me up,' I love them all tremendously. We have been though a lot together, and I owe them all so very much. They have taught me, by example, how to be a human being before I am anything else. I hope I have learned that lesson. Those who have taught me these lessons best are my very dear Bholi Aunty, Apple, and Rano. A gift from above, some might say.

I am in the curious position of being in love with a woman whose heart knows no bounds. Curious because such people aren't supposed to exist, and curious because I

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I dedicate this thesis to my mom, Parminder Pal, to whom I literally owe everything; to my brother, Aminder Singh Multani, who fills my heart with pride and joy; and to the memory of my father, Kashmir Singh, whom I continue to miss, every second of every day.

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# Chapter 1

## Introduction

This thesis will argue for four broad claims: (1) That local contexts are needed for a descriptively adequate theory of linguistic interpretation, (2) That presupposition accommodation is made with respect to a set of grammatically defined candidates, (3) That the set of accommodation candidates is derived from the same linguistic objects that are used to derive candidates for implicature (the scalar alternatives of the asserted sentence), (4) That scalar implicatures and accommodated propositions are the output of Fox's [31] procedure of innocent exclusion, modified so as to consider implicature candidates and accommodation candidates together. I argue for claim (1) in Chapter 2 by arguing that Heim's principle of *Maximize Presupposition!* should be checked in local contexts (Local MP). The argument rests on showing that Local MP makes the best sense of a puzzle discovered by Percus [93], and by providing new evidence that its predictions are better supported than the prevailing alternative (Percus [93]). In Chapter 3, I use Local MP to account for an array of blocking effects. We will see that Local MP can help to shed light on the semantics of *only*, counterfactual conditionals, and focus interpretation. This chapter highlights the importance of dynamically changing assignment functions in a theory of interpretation. I argue for claims (2)-(4) in Chapters 4 and 5 by attempting to address the proviso problem (Geurts [43]), as well as a new puzzle for the theory of implicature that arises in the study of attitude ascriptions.

## 1.1 Local Contexts

Local contexts are at the heart of the interpretive machinery in dynamic semantics (eg. Heim [55]), but are absent from some of the more standard textbook treatments of natural language semantics (eg. Heim and Kratzer [61]). In dynamic systems, logical forms do not denote propositions, but rather context change potentials, functions from contexts to contexts. Crucially, contexts can get updated sentence-internally, so that subconstituents get interpreted with respect to a context  $c'$  that is different from the global context  $c$  of the sentence itself. Do we really need these enrichments of our standard semantic machinery?

With presupposition and anaphora as early motivations, it was claimed (Heim [53, 55, 54]) that we do. On the one hand, the appeal to local contexts helped formulate certain solutions to presupposition projection that were clear improvements over the predictions of Gazdar's [41] competing framework. In addition, while it shared many of the predictions laid out in Karttunen and Peters' [74] theory of projection, it was argued that the dynamic framework provided gains in explanatory adequacy. The Karttunen and Peters [74] system required the stipulation of a component of the grammar specifically dedicated to presupposition projection. Heim asserted that the dynamic framework managed to avoid such stipulations in that its lexical entries, designed to get the truth-conditions right, at the same time solved the projection problem for free.

The theory has since been attacked on both the descriptive and the explanatory front. In terms of descriptive adequacy, one of the major attacks has come in the form of the proviso problem, a problem raised most explicitly by Geurts [43] for the theory's predictions about presupposition projection. I'll get back to this in Section 1.2. In terms of explanatory adequacy, it was argued early on that the theory does not, in fact, avoid stipulation after all (Soames [121], Mats Rooth in a personal letter to Irene Heim [56]). The lexical entries effectively end up encoding their projection properties. If one cannot find independent motivation for the lexical entries, which are what derive local contexts, then claims to explanatory adequacy must be dropped.

This concern has given rise to recent works attempting to capture the predictions of the dynamic framework from more general principles (Schlenker [107, 109], Fox [33], George [42]).

In Chapters 2 and 3, I argue that despite the concerns about lexical stipulations, there is evidence that local contexts are manipulated as first-class citizens in linguistic interpretation. My arguments come from an investigation of some of the properties of Heim's [57] principle of *Maximize Presupposition!* (henceforth MP). In Chapter 2, I argue that the best way of accounting for certain blocking effects is by reformulating MP so as to have it apply locally. In Chapter 3 I argue that such a principle (Local MP) buys us insights into various seemingly unrelated domains, such as the semantics of focussing adverbs, counterfactual conditionals, and the theory of focus interpretation. More generally, this discussion aims to re-establish the importance of anaphora as one of the motivators of the idea that contexts are updated sentence internally.

### 1.1.1 Local MP

Chapter 2 examines Heim's [57] MP, a blocking principle motivated by contrasts like the following:

1. (a) # A sun is shining  
(b) The sun is shining
  
2. (a) # All of John's hands are on the table  
(b) Both of John's hands are on the table

The principle has been the subject of much recent investigation (Sauerland [104], Percus [93], Schlenker [106], Chemla [14], Magri [88], Singh [118]). Very roughly, it is a blocking principle which encodes a preference for presuppositionally stronger LFs. More specifically, in cases where two competing LFs are contextually equivalent, but where one (eg. the (b) sentences) presupposes more than the other (eg. the (a) sentences), and its presuppositions are met in the context of use, the alternative with

the stronger presuppositions (eg. the (b) sentences) must be used. For example, given our common knowledge that there is exactly one sun, (1a) and (1b) are contextually equivalent, but since (1b) has greater presuppositional requirements, which are met in our context, (1b) must be used instead of (1a).

Orin Percus [93] first discovered cases that seem problematic for this principle. What Percus found were pairs of sentences which, according to standard theories of presupposition projection (eg. Karttunen and Peters [96], Heim [55], Beaver [4], Schlenker [107]), presuppose nothing at all, but which seem to enter into MP type blocking effects:

3. (a) # If John has exactly two students, I'm sure all of them will flourish
- (b) If John has exactly two students, I'm sure both of them will flourish

If (3a) and (3b) have no presuppositions, why does (b) still block (a)? Percus formulates a modified notion of MP which operates not over contexts and propositions, but rather over properties of lexical items. I suggest in Chapter 2 that the essential character of MP can be retained if we view it as applying not globally, but rather locally. Given a theory that employs local contexts (eg. Heim [55], van der Sandt [103], Schlenker [108]), we can state the principle as follows.

**Local MP** If  $\phi$  is a sentence used in context  $c$ , and  $\psi_1, \dots, \psi_k$  are constituents of  $\phi$ , then MP is checked at the local context of all constituents  $\psi_i, 1 \leq i \leq k$

The local context of the consequent entails that John has exactly two students. With respect to this context,  $c, c+All\ of\ John's\ students\ will\ flourish = c+ Both\ of\ John's\ students\ will\ flourish$ . Since the sentence with *both* presupposes more than its competitor with *all*, Local MP ensures the sentence with *both* is used.

If the principle is correct, one immediate consequence is that theories of natural language interpretation need to employ local contexts. With the resources provided by local contexts, we are able to state MP in a way that I believe is conceptually more natural than Percus' [93] alternative. More importantly, I argue in Chapter 2 that Local MP enjoys empirical advantages as well.

### 1.1.2 Applications of Local MP

In Chapter 3 I turn to various applications of Local MP. The focus of attention is the existence of a class of blocking effects which on the face of it are quite puzzling, but which end up receiving a fairly straightforward explanation under Local MP. More specifically, I look at certain cases where the use of lexical items such as *only*, *too*, and *he* seems to be obligatory:

4. (a) # Either John and Mary both came to the party or John came to the party  
(b) Either John and Mary both came to the party or only John came to the party
5. (a) # John went to the party, and Mary did.  
(b) John went to the party, and Mary did too.
6. (a) # A man<sub>i</sub> came in, and a man<sub>i</sub> started yelling  
(b) A man<sub>i</sub> came in, and he<sub>i</sub> started yelling

I argue that in each case, in the relevant local context, the relevant subconstituent in (b) locally blocks its competing subconstituent in (a) under Local MP. To tell such a story, we have to: (1) Say what the competing alternatives are, (2) Say what the local context of the relevant constituents is, (3) Ensure that the LF of the relevant constituent in (b) carries stronger presuppositions than its competitor in (a), (4) Ensure that the presuppositions of the presuppositionally stronger competitor are met in the local context, (5) Ensure that in each case the competing constituents are contextually equivalent (i.e. with respect to their local context). Chapter 3 is dedicated to spelling out these and related details, but let me try to convey a sense of the nature of the explanation here.

Consider (4a). On the face it, there is a simple account of its oddness. We know from Hurford's Constraint (Hurford [67]) that disjunctions where one disjunct entails the other are infelicitous (eg. # *John lives in Paris or France*). However, under the assumption that natural language has a silent exhaustive operator *exh* available, the continued oddness is something of a mystery. With an *exh* on the second disjunct,

(4a) would manage to escape Hurford’s Constraint entirely, exactly in the way that adding an overt *only* ensures that (4b) does not violate Hurford’s Constraint. I believe this is a clue: I will propose that  $only(C)(\phi)$  and  $exh(C)(\phi)$  compete, and sometimes,  $only(C)(\phi)$  wins. What is the relevant blocking principle? I propose in Chapter 3 that the blocking principle is Local MP. Thus, (4a) will be odd because, without an exhaustive operator, it violates Hurford’s Constraint. Attempting to rescue the sentence by *exh*-insertion will not help, because, under Local MP, there’s a better way to save it, namely, by adding *only*. To make this account work, I will have to convince you that in the local context  $c$  of the second disjunct,  $only(C)(\phi)$  has presuppositions that are met in  $c$ , that these presuppositions are stronger than those of  $exh(C)(\phi)$ , and that  $c + only(C)(\phi) = c + exh(C)(\phi)$ .

I will work through some of the details in Chapter 3, but, roughly, I will argue that the standard treatments of the semantics of *only* have to be revised for our account to work. I will motivate the need for such a revision, and will go on to propose an analysis of *only* under which  $only(C)(\phi)$  asserts the same thing as  $exh(C)(\phi)$ , namely, it asserts  $\phi$  and the negation of various alternatives in  $C$  (following Fox [31]). This will ensure that  $only(C)(\phi)$  and  $exh(C)(\phi)$  increment contexts in the same way. As for presuppositions, I will propose (following the general theory of focus semantics of Rooth [100]) that  $exh(C)(\phi)$  presupposes that there is an alternative  $\psi$  in  $C$  distinct from  $\phi$ , while  $only(C)(\phi)$  presupposes that there is a less expected/more noteworthy alternative  $\psi$  in  $C$  (following Horn [65]). This will ensure that  $only(C)(\phi)$  is presuppositionally stronger than  $exh(C)(\phi)$ . The reader will no doubt have noticed that my suggested analysis deviates from Horn [65] and Fox [31] in rejecting the idea that  $only(C)(\phi)$  also presupposes  $\phi$ . I therefore need to say something about why  $\phi$  projects out of  $\neg(only(\phi))$  (eg. *John didn’t eat only SOME of the cookies* implies that he ate some of the cookies). I argue that this inference can and should be derived as an implicature, and proceed to do so by taking advantage of recent developments in the theory of implicature (Fox and Spector [17]).

What remains then is to say why the local context of the second disjunct in (9b) satisfies the presuppositions of  $only(C)(\phi)$ . Since  $C$  is a free variable that receives its

value through an assignment function, its value will be sensitive to what is salient. Assuming that a disjunct  $X$  that is pronounced before a disjunct  $Y$  is thereby salient at the time  $Y$  is evaluated, the earlier disjunct  $J \wedge M$  will be in  $C$ . Since  $J \wedge M$  asymmetrically entails  $J$ , it is (under any reasonable notion of ‘expectation’) less expected. The presupposition of  $only(C)(John)$  will thus be satisfied, and so the parse with  $exh$  will be unavailable, by Local MP.

Note that the salience-based account readily extends to the fact that  $only(C)(John)$  doesn’t block  $exh(C)(John)$  when we reverse the order of the disjuncts:

7. (a) Either John came to the party or John and Mary both came to the party
- (b) Either only John came to the party or John and Mary both came to the party

Given Hurford’s constraint, we know that there has to be an  $exh$  on the first disjunct of (7a). But it is not blocked by  $only$  in this case. The reason why both  $only$  and  $exh$  are fine at the first disjunct is that in this environment, Local MP is entirely irrelevant: nothing else is salient, so the local context doesn’t necessarily satisfy the presupposition of  $only(C)(John)$  (that there is a more noteworthy alternative). As a result, either way of rescuing the LF from Hurford’s Constraint will do.<sup>1</sup>

We will see that under our proposed entries for  $only$  and  $exh$ , and under the assumption that Local MP is operative in grammar, we can also account for contrasts like the following:

8. (a) If John had come to the party, it would have been great; but if John and Mary had both come to the party, it would have been terrible
- (b) # If John and Mary had both come to the party, it would have been terrible; but if John had come, it would be great
- (c) If John and Mary had both come to the party, it would have been terrible; but if only John had come, it would be great

---

<sup>1</sup>Though the use of  $only$  would then require accommodation. As we argue in Chapter 2, Local MP is checked before any accommodation has a chance to take place, so the required accommodation cannot turn Local MP from being irrelevant to being applicable.

9. (a) It's possible that John came to the party and it's possible that John and Mary both came to the party
- (b) # It's possible that John and Mary both came to the party and it's possible that John came to the party
- (c) It's possible that John and Mary both came to the party and it's possible that only John came to the party

For instance, consider (8a), a so-called 'Sobel Sequence' (Lewis [85]). Under a monotonic semantics for conditionals such a sequence would be predicted to be contradictory. But since it is felicitous, Lewis [85] argued, it must be consistent. He used this fact to motivate a non-monotonic semantics for conditionals, sharing much in common with Stalnaker's [124] treatment.

Building on arguments in Chierchia, Fox, and Spector [17], I argue that the behaviour of Sobel Sequences does not in fact support a modification of the sort envisioned by Stalnaker and Lewis. Instead, I argue that such facts are best accounted for if we assume a monotonic semantics for conditionals in conjunction with a covert exhaustive operator, *exh*. When *exh* is assumed, the Sobel Sequence ends up meaning something like 'if only John had come to the party, it would have been great; but if John and Mary both had come to the party, it would have been terrible.' Such a sequence is indeed consistent. Moreover, when a local implicature is unavailable (for well-understood reasons), the sequence will be predicted under *exh* to be bad, in a way not (obviously) predicted by a treatment in the Stalnaker-Lewis tradition:

10. # If John or Mary or Both had come to the party, it would have been great; but if John and Mary both had come, it would have been terrible

Returning now to (8), if *exh* can rescue (8a), why can't it also rescue (8b)? It should be clear what we will say: that *exh*-insertion is disallowed in this environment, because, under Local MP, an *only* is the only way to convey the required meaning. Without an *exh*, then, the sentence is contradictory, as predicted by a monotonic semantics.

A similar line of explanation will account for the pattern in (9). Sentence (9b), without an *exh*, will be ruled out by an independent constraint that rules out conjunctions where the second conjunct is entailed by the first (Horn [64]):

11. John lives in France, and his home is in Paris
12. # John's home is in Paris, and he lives in France

An *exh* under the modal of the second conjunct could rescue the sentence, but then, under Local MP, there will be a better way to do so, viz. adding an overt *only* there. And again, in (9a) Local MP will be irrelevant. For the argument to go through, we will see that we need possibility operators to be filters for presupposition, rather than holes, as standardly assumed (Karttunen [71]). We will argue that a filter-based analysis is indeed motivated on independent grounds.

This will be our general line of explanation for the obligatoriness of *only* in (4)-(6). Without an overt *only*, the sentence will either be odd because it violates Local MP under a parse with *exh*, or it violates some other constraints (eg. Hurford's Constraint, Redundancy, Consistency) under a parse without *exh*. Let me also say a little bit here about the other cases we saw earlier ((5) = obligatory *too*, (6) = obligatory *he*).

The contrast in (5) will be accounted for in the following way. In the local context of the second conjunct, *Mary did too* competes with *Mary did* under Local MP, and the former wins. Before we go any further with this, we are faced with an immediate puzzle. Why are they competing at all? In general, the competitors for Local MP are of the same syntactic complexity, but here the winning candidate seems to be strictly more complex, given the additive particle *too*. I will argue that the phonology is misleading here, and that the competing structures are of equal complexity. More specifically, I argue that the LF in (5a) is something like:

- $[PAST[\text{John come to the party}]_7]$ , and  $[PAST[[\text{Mary}]_F \text{ came to the store}]]_{\sim 7}$

Here,  $\sim$  is Rooth's [100] squiggle operator. The LF of its competitor, (5b), will be argued to be:

- $[PAST[\text{John come to the store}]_7]$ , and  $[PAST[[\text{Bill}]_F \text{ came to the store}]]_{too_7}$

These structures, which are consistent with certain assumptions about VP-ellipsis (eg. Heim [59]), allow the competitors to be of equal structural complexity.<sup>2</sup>

But now we are faced with a second problem. Rooth’s [100] theory of focus interpretation posits the existence of a single focus interpretation operator,  $\sim$ . If this is true, then the structure with *too* will again have to be more complex, given the existence of the squiggle somewhere in the structure. Instead, I propose to modify Rooth’s theory by allowing certain operators (such as *too*) to interpret focus directly. Under this assumption, I provide an entry for *too* that does just this while ensuring that the sentence with *too* carries greater presuppositions than the sentence with  $\sim$ . I argue that this modification of Rooth’s theory does not constitute a radical revision, in that it requires a slight modification of a single axiom. The axiom stipulates a semantics for  $\sim$ . My proposed modification is to have the stipulation provide a minimal semantics for all focus interpretation operators  $O$ , where  $\sim$  is just one such operator. Other operators (such as *too*) may differ in their phonology, and may have additional semantic properties, but none of these properties may reference focus in any way. This will still allow focus effects to be derived as theorems of Rooth’s axioms.<sup>3</sup>

Finally, the blocking effect in (6) is easily derived by Heim’s [53, 55, 54] Novelty/Familiarity condition. This condition essentially states that  $a\ man_i$  can be used only if  $i$  is not in the domain of the assignment function, while  $he_i$  may only be used if  $i$  is in the domain of the assignment function. Since the first conjunct in both (6a) and (6b) updates  $g$  by adding index  $i$  to it (Heim [53, 55, 54]), (6b) ends up satisfying the Novelty/Familiarity condition, while (6a) doesn’t. Hence the oddness. Once we see the world through the lens of Local MP, however, we can drop the constraint on indefinites entirely. With this revision, indefinites will always be defined. However, they might sometimes be blocked in Local MP competitions if they happen to effect the same update to a context as a presuppositionally stronger alternative. We will

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<sup>2</sup>Under the metric of complexity found in Katzir [77].

<sup>3</sup>Though see Beaver and Clark [7].

show that the local context of the second conjunct of (6a) is one such context. More generally, we might try to use such a principle to predict the distribution of discourse referents, though I don't attempt any detailed investigation here.

One general conclusion that follows from the discussion of Chapter 3 is that assignment functions dynamically get updated as a sentence is processed. As I hope will become clear in Chapter 3, all the facts discussed above fall out as Local MP blocking effects in which the only relevant difference between the competing structures involves the constraints they impose on assignment functions. This is of course not a new idea. For example, Lewis [86] provided extensive support for the fact that what is salient is important in governing appropriate moves in a language game, and that what is salient dynamically changes across discourse.

Having argued for the need for local contexts, we are still left with the problem of motivating them. I have nothing to offer here. Philippe Schlenker [108] has proposed a general 'laziness principle,' with many affinities to principles of lazy evaluation familiar from computer science (eg. Abelson and Sussman [2]), with the hope of using this general principle and a classical semantics to derive the local context of any constituent.<sup>4</sup> Beaver [4] suggests that upon examining other domains, such as epistemic modality, the entries stipulated in Heim [55] seem to be the only ones compatible with the semantics of epistemic modals. Alternatively, we might try deriving local contexts from general principles of grammatical architecture (eg. cyclic interpretation, Chomsky [18]), perhaps on a par with local interpretation in phonology (eg. stress assignment, Bresnan [12]).<sup>5</sup> Whatever the best approach, if the arguments for local contexts here are sound, then they clearly call for some principled explanation of why, given the vast space of possible lexical entries, we find only the ones we do.

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<sup>4</sup>Fox [33] and George [42] posit a similar evaluation principle in their Incremental Strong Kleene systems. A recent manuscript (LaCasse [83]) also attempts to restrict the entries of dynamic frameworks, but this manuscript reached me too late for me to have a chance to discuss it here.

<sup>5</sup>Asaf Bachrach (p.c.) and Roni Katzir (p.c.) also raised potential avenues of investigation along these lines. I thank them for very illuminating discussion.

## 1.2 The Proviso Problem

In terms of descriptive adequacy, the major problem raised for the dynamic framework is what Geurts [43] calls the proviso problem. The criticism is that the theory predicts presuppositions that seem to be too weak. For example, it predicts the following sentence to presuppose that if John flies to Toronto, he has a sister:

13. If John flies to Toronto, his sister will pick him up from the airport

However, what we all take away from the sentence is something rather stronger than this, namely, we infer that John does in fact have a sister. Here is another example of this kind:

14. John believes it stopped raining

The theory predicts this sentence to presuppose that John believes it was raining (Karttunen [71, 72], Heim [55]), and again, we take away something in addition to this, namely, that it was in fact raining. Can the theory be made consistent with these facts? Geurts [43, 44] has argued that it cannot.

Proponents of the dynamic framework have of course responded to these concerns (Beaver [4, 6], Beaver and Zeevat [9], von Stechow [25], Heim [60], Pérez Carballo [94], van Rooij [97]). The main thrust of the response is that the theory is absolutely right about its predictions concerning presupposition *projection*, but that the theory of projection needs to be supplemented with an account of presupposition *accommodation*. If presuppositions are viewed as constraints on the context of use, and if these constraints are not met, hearers may need to sometimes carry out some form of contextual repair in order to ensure the context meets the required constraints (Karttunen [72], Stalnaker [125], Lewis [86]). While grammar is responsible for projection, pragmatic reasoning is responsible for accommodation. This means that the proviso problem is not specific to dynamic frameworks: it will arise for any theory of presupposition that properly distinguishes between presupposition projection and presupposition accommodation (eg. Karttunen and Peters [74], Beaver and Krahmer

[8], Schlenker [107, 109, 108], Fox [33], George [42]). Since all theories of this kind predict weak presuppositions, they will all have to make some such line of response. Assuming now this architectural division of labour between grammar and pragmatics, how might it be applied to the proviso problem?

Take (13), for example. Here, grammar will tell pragmatics that it needs at least the following proposition to hold in the context: that if John flies to Toronto, he has a sister. Pragmatic reasoning then needs to figure out what the best proposition to accommodate is in order to meet this demand. Whatever the nature of this kind of reasoning, we know it decides that it would make the most sense to accommodate that John has a sister whether or not he flies to Toronto. It has been argued that such a decision comes not from the theory of logic, but from the theory of common sense reasoning (eg. Beaver [4], Beaver and Zeevat [9], von Stechow [25], Heim [60]).

In response to this, Geurts [43, 44] argues that this style of reasoning won't suffice, even if we black-box-out the (currently missing) theory of common sense reasoning. His reason for dismissing this division of labour comes from the fact that we can construct cases where the semantic presupposition is identical with (13), but where we do not infer that John has a sister. A case of this kind is as in (15):

15. Mary knows that if John flies to Toronto, he has a sister

If common sense reasoning (whatever that may be) tells you to accommodate that John has a sister in response to (13), why doesn't it do so in response to (15)?

Geurts [44] makes a similar argument with respect to (14). We can generate the same presupposition by explicitly representing it and embedding under *know*, and we do not, as opposed to (14), infer that it was in fact raining:

16. Mary knows that John believes it was raining

Note that when the presupposition is explicitly represented (as in (15) and (16)), we do not strengthen it. I will suggest that this is because the sentences in (15) and (16) differ from the ones in (13) and (14) in that they have different scalar alternatives, and that the way we reason with alternatives ensures that there is no strengthening in (15) and (16). Let me turn to this line of argument now.

### 1.2.1 Formal Alternatives for Presupposition Accommodation

In Chapters 4 and 5 I will argue that Geurts was right: the proposed division of labour cannot be maintained. I will argue instead that presupposition accommodation is governed by a formal system within the grammar itself. The argument takes the following general shape. First, I will argue that presupposition accommodation takes place with respect to a set of *formal* alternatives. Second, I provide a hypothesis concerning the space of alternatives. Third, I provide an algorithm that determines which proposition(s) out of the space of alternatives get accommodated. I discuss the first two points here, and will discuss the third in the next section.

The argument for formal alternatives rests on showing that accommodation is, in principle, encapsulated from various things we know about the world. I provide two diagnostics to support this claim: (1) I use the *Hey wait a minute!* test (Shanon [111], von Stechow [25]) to show that accommodation is blind to common knowledge,<sup>6</sup> and (2) I use certain peculiar properties of epistemic *must* (Karttunen [70]) to show that accommodated propositions are the result of grammatical computations, not extragrammatical reasoning. Let me briefly discuss each in turn.

If a hearer is forced to accommodate  $p$  in context  $c$ , she is within her conversational rights to object, *Hey wait a minute! I didn't know that p!*:

17. S: John's sister will pick me up from the airport

H: Hey wait a minute! I didn't know John has a sister!

18. S: It surprised me that it was raining in Chicago

H: Hey wait a minute! I didn't know it was raining in Chicago!

Now, suppose it is common knowledge that John has a dog if and only if he has a German Shepherd. Suppose further that it hasn't yet been established whether John has a dog or not. Now consider the following dialogues:

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<sup>6</sup>I first made this argument in Singh [116].

19. S: John's out walking his dog

H: # Hey wait a minute! I didn't know John has a German Shepherd!

H: Hey wait a minute! I didn't know John has a dog!

The point of this example is this. Since accommodating that John has a dog takes you to the same target common ground as accommodating that John has a German Shepherd, given common knowledge, then accommodating either should be equally good in response to (19). But it seems that only accommodation of the semantic presupposition itself can take place, given that that is the only felicitous HWAM objection available here. It will turn out upon closer inspection that the HWAMT has various additional complicated properties, but we will see that these do not affect the conclusion about modularity.

A second probe for modularity is the following. Based on certain observations first made in Karttunen [70], it's been known that it is very odd to use epistemic *must* with a prejacent which you 'directly observe.' For example, if you open the windows and see that it's raining, you cannot utter:

20. # It must be raining

I show that the outputs of compositional semantics count as 'directly observed' as far as this test goes. In fact, I believe it offers a good test for ambiguity. For example, consider the following contrasts:

21. S: I saw the man with the telescope (Intended: NP-modification)

H: # Oh, he must have had a telescope

22. S: John has a ball

H: Oh, it must be green

Since (21) is odd, we can conclude that (21) is a reading of the sentence. Sentence (22) is fine, so there cannot be a reading of the sentence meaning that John has a green ball (i.e. the sentence is not ambiguous between 'John has a green ball' and 'John has a red ball' etc.). Now, if *must* cannot take the outputs of grammar as

prejacent, then the following is further evidence that presupposition accommodation is taken care of within the language faculty without accessing world knowledge:

23. S: Have you met my sister?

H: # Oh, you must have a sister

It has also been argued (Chierchia [16], Fox and Hackl [35], Fox [31], Magri [88], Chierchia, Fox, and Spector [17], Singh [118]) that implicatures are computed within the grammar. The epistemic *must* test supports this further:

24. H: Which of John and Mary came to the party?

S: John came

H: # Oh, Mary must not have come

With accommodation and implicatures both governed by grammar-internal systems, we might expect a close relation between them. This is indeed what I conclude. I propose a system of grammatical inference under which the grammar makes available a set of objects, the scalar alternatives of a sentence. Implicatures and accommodated presuppositions are both derived from this set of alternatives. Let me briefly outline the major aspects of this system.

Suppose  $\phi$  is the asserted sentence. Let  $A(\phi)$  be the set of scalar alternatives of the sentences, a set of alternative structures that I will assume are derived using Katzir's [77] procedure. It is standard to use  $A(\phi)$  to generate a set of propositions,  $ALT(\phi) = \{r : r = [[\psi]], \psi \in A(\phi)\}$ , which will be the basis for implicature computation. Since it is the negations of these propositions that are candidates for implicature, we can just as well assume that we have the following set of candidates for implicature:

**Candidates for Implicature** The candidate set of propositions for implicature is

$$\mathcal{N} = \{\neg r : r \in ALT(\phi)\}$$

This much is standard. Now if  $\pi(\psi)$  is the (semantic) presupposition of sentence  $\psi$ , computed using one's favourite theory of presupposition projection, I propose that we have the following set of alternatives for accommodation:

**Candidates for Accommodation** If  $\phi$  is asserted in context  $c$ , and accommodation is required, the set of alternatives for accommodation is:  $\mathcal{H} = \{p : p = \pi(\psi), \psi \in A(\phi)\}$

We now have two sets of propositions, a set of candidates for implicature  $\mathcal{N}$ , and a set of candidates for accommodation  $\mathcal{H}$ . We need a theory of reasoning that works with these sets.

### 1.2.2 Procedure for Computing Implicatures and Accommodation

We need to say how implicatures are computed, and we need to say how accommodation works. Fox [31] already has a procedure that computes implicatures.<sup>7</sup> The input to his algorithm is the set of implicature candidates,  $\mathcal{N}$ . The algorithm is greedy in that it wants to conclude as many of the propositions in  $\mathcal{N}$  as it can. Imagine that it computes implicatures by using the following strategy: Find a maximal consistent subset  $M$  of  $\mathcal{N}$ , and infer each proposition in  $M$  as an implicature. The procedure's greed is constrained in various ways, however. First, the conjunction of the propositions in  $M$  must retain consistency with  $\phi$ . Second, it may sometimes happen that there are multiple such maximally consistent subsets that are consistent with  $\phi$ :  $M_1, \dots, M_k$ . It would seem, then, that the only propositions that it could non-arbitrarily accept as implicatures would be those that are in every maximally consistent subset, i.e.  $M_1 \cap \dots \cap M_k$ . These are the innocently includable propositions, and these are the scalar implicatures predicted by Fox's system.

Now, I propose that accommodation works using the same procedure. Crucially, however, it does not operate on a separate tier. Instead, candidates for implicature and candidates for accommodation are considered together. In other words, I propose that the input to Fox's procedure is not  $\mathcal{N}$ , but rather  $\mathcal{N} \cup \mathcal{H}$ . In addition to capturing all the proviso facts discussed above, we will see that the resulting bidirectional influence between implicatures and presuppositions solves an independent problem for

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<sup>7</sup>My discussion of Fox's system uses slightly different notation, but nothing of consequence follows.

the theory of implicature itself. For example, Fox's procedure predicts the following sentence to implicate that it wasn't raining:

25. John believes it was raining

This is because, under our assumptions about alternatives,  $A(25) = \{K_j r, r\}$ .<sup>8</sup> Using the same notation to pick out sentences and the propositions they denote, we'll have  $ALT(25) = \{K_j r, r\}$ , so that  $\mathcal{N} = \{\neg K_j r, \neg r\}$ . Both propositions will be innocently includable. However, if we consider presuppositions as well, we have:  $\mathcal{H} = \{r\}$ , so that  $\mathcal{N} \cup \mathcal{H} = \{\neg K_j r, \neg r\}$ . The only innocently includable proposition now will be that John doesn't know that it's raining, as required. This result can only be had by allowing candidates for accommodation to create symmetry problems for candidates for implicature. More generally, we will see that we need to allow accommodation candidates and implicature candidates to create symmetry problems for each other. We capture this by having innocent inclusion work over  $\mathcal{N} \cup \mathcal{H}$ .

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<sup>8</sup>I ignore the assertion itself.

## Chapter 2

# Maximize Presupposition as Local Blocking

Irene Heim [57] discovered that in certain cases, when two sentences convey the same information in a given context, only one of them can felicitously be used. More specifically, if a sentence  $\phi$  and a sentence  $\psi$  update the context in the same way, but  $\phi$  has stronger presuppositions than  $\psi$ , which are met in context  $c$ , then a principle of language use seems to force the speaker to use  $\phi$  in  $c$ , rather than  $\psi$ . This force has been characterized as a pragmatic maxim of language use, *Maximize Presupposition!*, which guides speakers and hearers to select, out of a set of competing logical forms, that which has the strongest presuppositions that are met in the context (Sauerland [104], Percus [93], Schlenker [106], Magri [88]). All formal statements of *Maximize Presupposition!* (henceforth MP) that I am aware of characterize it as a global constraint, operative at the root. The goal of this chapter is to show that this architectural assumption needs to be revised. Building on data first observed by Percus [93], I will argue that MP is a formal principle that is checked in the local context of each embedded sentence. Should the arguments presented here be sound, we will be able to make some claims concerning certain choice points in our understanding of dynamic systems of interpretation (Heim [55]), which might require some rethinking in our understanding of presupposition projection and accommodation within such frameworks.

## 2.1 MP as Global, Pragmatic Competition

Consider the contrasts below:

1. # A sun is shining
2. The sun is shining
3. # All of John's eyes are open
4. Both of John's eyes are open

Take the contrast between (1) and (2), for instance. How would MP account for it? We should begin by setting up some background assumptions.

First, let us assume the following lexical entries for the articles:

### Lexical Entry 1 (The Definite Article)

$[[theX]Y]$  expresses that proposition which is: (a) true at index  $i$  if there is exactly one  $X$  at  $i$ , and it is  $Y$  at  $i$ , (b) false at  $i$  if there is exactly one  $X$  at  $i$ , and it is not  $Y$  at  $i$ , (c) truth-valueless at  $i$  if there isn't exactly one  $X$  at  $i$

### Lexical Entry 2 (The Indefinite Article)

$[[a(n)X]Y]$  expresses that proposition which is true at index  $i$  iff there is at least one individual at  $i$  that is both  $X$  at  $i$  and  $Y$  and  $i$ .

We also assume the following definition of 'contextual equivalence,' borrowed from Sauerland [104] and Schlenker [106]:

### Definition 1 (Contextual Equivalence)

LFs  $\phi$  and  $\psi$  are contextually equivalent with respect to context  $c$  iff  $\{w \in c : [[\phi]](w) = 1\} = \{w \in c : [[\psi(w)]] = 1\}$

In words, this definition states that, given a context  $c$  as input, two LFs are contextually equivalent with respect to  $c$  if they take  $c$  to the same output context  $c'$ . We will just say 'contextually equivalent' whenever a background context is understood.

Let us return now to our contrast between (1) and (2). First note that our common knowledge entails that there is exactly one sun. As such, given our definition of contextual equivalence, it turns out that (1) and (2) end up being contextually equivalent. If there is exactly one sun in every world of evaluation, both (1) and (2) take us to an output context where this one sun is shining. But if both LFs serve the same communicative function (i.e. map the same input context to the same output context), why should (1) be odd, while (2) is perfectly felicitous?

The contrast was first noted in Hawkins [51]. He used it to argue that definites are subject to an ‘inclusiveness’ condition and indefinites to an ‘exclusiveness’ condition, by which was meant simply that *the N* can only be used if there is exactly one N in the context, and *a(n) N* can be used only if there are many N in the context. Heim [57] presents crucial evidence against the exclusiveness condition for indefinites. For instance, the following sentence does not presuppose that there are at least two 20 ft. catfish:<sup>1</sup>

5. Robert caught a 20 ft. catfish

Heim proposes instead that only the definite is presuppositional (cf. our lexical entries above). In addition, she suggests that there must be a principle in force urging us to use  $[[the X] Y]$  instead of  $[[a(n) X] Y]$  in contexts where the presuppositions of the former are met. She speculates that perhaps a maxim guiding us to make our conversational contributions presuppose as much as possible might generally be operative in communication. Sauerland [104], Percus [93], and Schlenker [106] generalize and formalize Heim’s speculative remarks. Sweeping certain irrelevant differences in their formulations under the rug, here, roughly, is a statement of MP that is (I believe) faithful to the intentions of all these works, which I’ll call ‘Standard MP:’

**Standard MP: MP as Global, Pragmatic Competition** If  $\phi$ ,  $\psi$  are contextually equivalent alternatives, and the presuppositions of  $\psi$  are stronger than those of  $\phi$ , and are met in the context of utterance  $c$ , then one must use  $\psi$ , not  $\phi$ .

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<sup>1</sup>One diagnostic for this is that you can’t felicitously apply the *Hey Wait a Minute!* Test (von Stechow [24]) here: # *Hey wait a minute! I didn’t know there are multiple 20 ft. catfish!*

This statement presents Standard MP as a solution to an optimization problem: Given a set of competing LFs that all update the current context  $c$  to a new output context  $c'$ , Standard MP determines that the best LF for carrying out this update is the one with the strongest presupposition satisfied in  $c$ . Many questions of a conceptual and technical sort immediately arise. On the conceptual front, how are we to make sense of this constraint? Can it be shown to follow from general principles of pragmatic reasoning, or from other principles of semantic competence? I will not have occasion to discuss these issues here.<sup>2</sup> In this chapter, my aim is to provide a fully precise, descriptively adequate statement of the principle.

If you go back to our definition of Standard MP just above, you will notice that we have appealed to an unanalyzed notion of ‘alternatives.’ To make the principle precise, therefore, it is necessary to spell out what this space of competing alternatives is. Much like work on scalar implicature, it has been thought that certain lexical items trigger MP competitions, and that the items themselves rest on certain scales. These scales have generally had to be stipulated. However, they are the only point at which stipulation is allowed. Once given, they can be used to mechanically derive the space of competing LFs. In our examples, for instance, the following lexical scales would need to be available:  $\langle a, the \rangle$ ,  $\langle both, all \rangle$ . These can multiply more generally:  $\langle believe, know \rangle$ ,  $\langle \emptyset, too \rangle$ , etc.<sup>3</sup> Given such scales, the space of alternatives can readily be derived.<sup>4</sup>

**Alternatives for Standard MP** If  $\langle \alpha, \beta \rangle$  is a scale, and  $\phi$  is an LF containing lexical item  $\alpha$ , and  $\psi$  is an LF that is everywhere like  $\phi$  except that at some terminal node it contains  $\beta$  where  $\phi$  contains  $\alpha$ , then  $\phi$  and  $\psi$  are alternatives.

Assuming a set of scales to be given, Standard MP has a well-formed set of alternatives that can be employed in any given context of use. Much like with scalar

<sup>2</sup>See Heim [57], Percus [93], Schlenker [106], Magri [88], and Singh [118] for discussion.

<sup>3</sup>As for the latter, such a scale would seem to be needed to make sense of the apparent obligatoriness of *too* in certain contexts (eg. Green [46, 47], Kaplan [69], Zeevat [135]), such as VP-ellipsis: *John came to the store. # Bill did.* versus *John came to the store. Bill did too.* In what follows I will make a certain assumption concerning the space of alternatives available that will prevent me from making use of this scale. But we will see that there is a fairly natural way to be restricted in this way while still capturing the facts.

<sup>4</sup>The definition can be generalized to n-ary scales in the usual way.

implicatures, it would be better if one had an intensional characterization of the alternatives. I will assume that such a characterization can be provided using Katzir’s [77] procedure for generating scalar alternatives. We will discuss this in greater detail in Chapter 5 (Section 5.1), but for now, I will assume with the literature that the answer to the question, *Where do alternatives come from?*, is that they are generated through the use of a stipulated set of scales, as in the above.

With this machinery in place, let us return now to the contrast between (1) and (2). As discussed above, given that it is common knowledge that there is exactly one sun, both sentences update the context in exactly the same way, viz. by taking us to a new context where the one sun that exists is shining. They are alternatives to one another, since  $\langle a, the \rangle$  is a scale. Furthermore, since the presupposition of (2) (that there is exactly one sun) is met in the context of use, Standard MP requires that the speaker use (2), rather than (1). By uttering (1), the speaker will have blatantly violated this principle of language use, generating the peculiar kind of oddness we detect upon hearing (1).<sup>5</sup> Once we define appropriate lexical entries for *both* and *all*,<sup>6</sup> the same reasoning we saw here would apply, mutatis mutandis, to account for the fact that (4) blocks (3).

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<sup>5</sup>It is tempting to try to articulate in greater detail the nature of this oddness. One can, of course, just state this as a brute force blocking effect. Alternatively, following Heim [57], some authors have argued that Standard MP gives rise to inferences of a particular sort (so-called ‘implicated presuppositions’ in the terminology of Sauerland [104]). Here is how the reasoning goes: Under the assumption that the speaker is a rational, cooperative agent, so that she is guided by the maxim Standard MP, her use of (1) signals that she does not take it to be common knowledge that there is exactly one sun. Since this proposition *is* common knowledge, hence common knowledge that it is common knowledge, she will be signalling something that contradicts the shared information between speaker and hearer. The result of this contradictory signalling results in oddness. There is also a further question of whether this reasoning is part of formal grammar (eg. Magri [88]), or pragmatics. We will revisit this architectural issue several times throughout this document.

<sup>6</sup>(1)  $[[bothX]Y]$  expresses that proposition which is: (a) true at index  $i$  if there are exactly two individuals that are  $X$  at  $i$ , and both these individuals are  $Y$  at  $i$ , (b) false at  $i$  if there are exactly two individuals that are  $X$  at  $i$ , and at least one of them is not  $Y$  at  $i$ , (c) truth-valueless at  $i$  if there aren’t exactly two  $X$  at  $i$ . (2)  $[[allX]Y]$  expresses that proposition which is true at  $i$  iff all individuals that are  $X$  at  $i$  are also  $Y$  at  $i$ .

## 2.2 Percus' Observation

Percus [93] pointed out a serious flaw in the formulation of Standard MP. Consider the following contrast:

6. Everyone with exactly two students assigned the same exercise to both his students
7. # Everyone with exactly two students assigned the same exercise to all his students

Under most theories of presupposition projection (eg. Karttunen and Peters [74], Heim [55], Schlenker [107, 109, 108]), universally quantified sentences *Every A B* presuppose that every element of *A* satisfies the presuppositions of *B*.<sup>7</sup> Thus, (6) is predicted to presuppose that everyone with exactly two students has exactly two students, i.e. it presupposes a tautology, which is to say it presupposes nothing at all. And since (7) contains no presupposition trigger, it also presupposes nothing at all. It follows that no context should be capable of discriminating between the two, and MP as stated should therefore never be relevant. Yet, the same contrast we observed in (1)-(4) seems to be at play here as well. In fact, we can generalize from Percus' example and quite easily generate sentences which presuppose nothing at all yet seem to be subject to some sort of MP-like competition:

8. If John has exactly two students and he assigned the same exercise to {both/ # all} of his students, then I'm sure he'll be happy
9. (Either John has exactly two students and he assigned the same exercise to {both/ # all} of his students) or he doesn't have any students at all
10. Mary believes that John has exactly two students and that he assigned the same exercise to {both/ # all} of his students

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<sup>7</sup>Beaver [4] makes a slightly different prediction, but his theory of presupposition suffers from the same difficulty in other constructions, such as the ones to be enumerated just below ((8)-(10)). In DRT systems (eg. van der Sandt [103], Geurts [44]), the question, *What does a complex sentence presuppose?*, is almost meaningless.

From the vantage point of Standard MP, these sentences are quite puzzling. First, globally, the competing sentences  $\phi$ ,  $\psi$  have no presuppositions. Second, embedded within them are sentences  $S$ ,  $S'$  which, when uttered in isolation, enter into MP competitions. It is as if  $\phi$ ,  $\psi$  compete by virtue of containing  $S$ ,  $S'$ . Moreover, it seems as though the outcome of the competition between  $\phi$ ,  $\psi$  is decided on the basis of which of  $S$ ,  $S'$  is presuppositionally stronger, even though this presuppositional difference is undetectable at the root. This pattern seems irreconcilable with the view that MP applies globally. Moreover, if MP is interpreted as a pragmatic constraint governing speech acts,<sup>8</sup> it is not *prima facie* clear what to make of the apparent fact that the MP triggering sentences in (6)-(10) sit in non-asserted positions (in the antecedent of a conditional, a disjunct in a disjunction, and under *believe*, none of which are positions where a speech act of assertion can normally be thought to be taking place). These observations suggest to me that we should either give up on the idea that MP operates at the root, or we should give up the idea that MP is at all relevant to accounting for the contrasts in (6)-(10).<sup>9</sup>

Despite this apparent tension, Percus [93] maintains both that MP is indeed behind the contrasts observed immediately above and that MP is a principle that operates globally, at the root. To account for the apparent application of MP in presuppositionless sentences, he modifies Standard MP along several dimensions. First, he introduces the notion of one lexical item (rather than a sentence or LF) being ‘presuppositionally stronger’ than another. The exact definition is not important for our discussion.<sup>10</sup> It should suffice to note that the formal definition captures precisely

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<sup>8</sup>As pointed out to me by Danny Fox (p.c.) and Kai von Stechow (p.c.), it is not clear that Standard MP need be interpreted this way. As far as I can tell, only two authors who have written on the subject have explicitly taken a view on the matter: For Schlenker [106], MP should be derived as a theorem of Gricean reasoning. For Magri [88], MP applies within the grammar, hence not pragmatic by definition. All authors have expressed the view that MP applies globally. A natural interpretation of this level of application is that it operates at the level of speech act. My point here is not to attribute this view to any particular author, but to raise a potential complication for the idea that MP is a pragmatic maxim governing speech acts.

<sup>9</sup>Hence, possibly also for all the other examples we’ve seen so far.

<sup>10</sup>“The intuitive idea is that *both* is ‘presuppositionally stronger’ than *all* for the following reason: if we take two simple sentences that differ only in that one contains *both* where the other contains *all*, the domain of the *both* sentence is always a domain of the *all* sentence, and sometimes a proper subset” (Percus [93], p.15). The formal definition is given in his (32), p.15: “*A* is ‘presuppositionally stronger’ than *B* iff the domain of  $[[B]]^*$  properly includes the domain of  $[[A]]^*$ , where  $[[A]]^*$  and

our intuition. For example, it works so that *the* is presuppositionally stronger than *a*, that *both* is presuppositionally stronger than *all*, etc. He then introduces a notion of the *lexical alternatives* of a lexical item:

**Lexical Alternatives** The *lexical alternatives* of a lexical item  $\alpha$  are all presuppositionally stronger lexical items  $\beta$  of the same category.

This is an asymmetric notion of alternative. According to this definition, *both* is a lexical alternative to *all*, but *all* is not an alternative to *both*.<sup>11</sup> He uses this notion of lexical alternatives to generate the candidate set of alternative sentences/LFs<sup>12</sup> that ultimately enter into MP competitions:

**Alternative-Family** The *Alternative Family* of LF  $\phi$  is the set of LFs that can be generated by replacing a lexical item in  $\phi$  with one of its lexical alternatives.

This definition ensures that any LF  $\phi$  containing (eg.) the lexical item *all* can be converted into an alternative LF  $\psi$  by replacing an occurrence of *all* with *both*. Given these notions, Percus offers the following reformulation of MP:

**Revised MP: MP as Global, Pragmatic Competition** Let  $\psi$  be a member of the Alternative-Family of  $\phi$ , and suppose  $\phi$  and  $\psi$  to be contextually equivalent.<sup>13</sup> Then one must not use  $\phi$  if the use of  $\psi$  would be felicitous in  $c$ .

Here is an illustration of how Percus' maxim works. Consider again sentence (7), *everyone with exactly two students assigned the same exercise to all his students*. This sentence has (6) as a member of its Alternative-Family, *everyone with exactly two*

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[[B]]\* are [[A]] and [[B]] adjusted to apply to sequences.”

<sup>11</sup>I am unable to see whether this asymmetry is important for his system, i.e. it seems to only affect the statements of the relevant principles, but not the actual predictions. Moreover, I believe he could also adopt the scalar alternatives of Katzir [77] quite readily, but the point I am about to make would come up either way. I thus stick to the letter of his formulation.

<sup>12</sup>Percus formulates the relevant principles in terms of sentences, not LFs. I will use both locutions, but always mean LFs. Whenever I say ‘sentence,’ the reader should take that to really mean the LF of the relevant sentence.

<sup>13</sup>Percus presents a slightly different version of ‘contextual equivalence’ than the one used here. He uses it to mean not that  $\phi$ ,  $\psi$  are true in the same worlds in  $c$ , but that they have the same value in all worlds in  $c$ . The distinction will not be crucial to anything we say here, so I will stick to our formulation as above.

*students assigned the same exercise to both his students.* (6) and (7) are, of course, equivalent in all contexts. Furthermore, the use of (6) is felicitous in all contexts. Since (6) is a member of (7)'s Alternative-Family, i.e. it can be generated from (7) by replacing *all* with the presuppositionally stronger item *both*, the use of (7) is blocked by (6). The reader can verify that Percus' reformulation of MP captures all of (6)-(10) without losing the ability to predict any of the standard MP contrasts we introduced at the beginning (eg. (1)-(4)).

## 2.3 Local versus Global Application of MP

My aim in this section is to motivate an alternative response to the data in (6)-(10). I shall begin by pointing to a consequence of Revised MP that I believe leads to a complicated view of the division of labour between formal semantic principles and maxims of language use. This tension will lead us to an alternative formulation of MP, one which will be shown to make empirically correct predictions that are not made by Percus' proposal.

### 2.3.1 The Domain Size of MP

As originally stated, (Standard) MP was a competition-based principle that decided between competing elements based on the information contained in the context *c*, on the one hand, and the conditions the competing elements imposed on *c*, on the other. Percus' discovery teaches us that this view is not tenable. His own response was to reanalyze MP as a principle that is sensitive to the lexical items that occur in structures, and not to the conditions imposed by LFs on the context of evaluation. I would like to suggest an alternative approach that attempts to retain the original character of MP as a principle that discriminates between LFs based on the definedness conditions they impose on the context of evaluation. However, the chief architectural innovation will come in the form of allowing the context of evaluation to change throughout the interpretation of a complex sentence. In effect, the context that is relevant for the application of MP will sometimes be the global context, but

will also sometimes be the local context  $c'$  of some embedded constituent, where  $c'$  can be different from  $c$ . I believe this move is a natural one to make, given that the appeal to dynamically changing contexts was primarily motivated by presuppositional facts in the first place (eg. Karttunen [72], Stalnaker [125, 130], Heim [55]). More important than my personal judgments of the conceptual naturalness of such an architecture, however, is the fact that the move to local application of MP makes concrete empirical predictions. I will show that in cases where such a principle differs from Percus' Revised MP, the facts side with the dynamic view.

For such a principle to be stated, one needs a theory that employs the notion of 'local context.' Many frameworks currently exist that make use of such a technical device (eg. Heim [55], van der Sandt [103], Schlenker [108]). The differences between them will be largely irrelevant for our purposes here. For concreteness, I follow the dynamic semantics approach of Heim [55].

In this approach, the meaning of a sentence is no longer a static proposition, but rather a Context Change Potential (CCP), a function taking a context as input, and returning a new context as output. For example, the context change potential of *it is raining* is a function,  $+it\ is\ raining$ , that takes a context  $c$  and returns a new context,  $c'$ , containing only worlds where it is raining:

$$11. c + it\ is\ raining = \{w \in c : \text{it is raining in } w\} = c'$$

Given CCPs for atomic sentences, the next step is to define CCPs for arbitrarily complex sentences. This is done by giving a recursive definition.<sup>14</sup> As an example, consider the sentence *it is raining and snow is white*. What is its context change potential?

For arbitrary conjunctions  $\phi \wedge \psi$ ,  $c + (\phi \wedge \psi) = ((c + \phi) + \psi)$ . A conjunction is thus a complex instruction to first update the context  $c$  with the first conjunct,  $\phi$ , creating an intermediate context  $c'$ . This intermediate context  $c'$  is then the input context to the operation  $+\psi$ , yielding an output context  $c''$  consisting of  $\phi$ -worlds and  $\psi$ -worlds. Schematically, supposing that we begin with a four-world context

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<sup>14</sup>Please see Heim [55] and Beaver [4] for a fragment.

$c = \{[\phi, \psi], [\phi, \neg\psi], [\neg\phi, \psi], [\neg\phi, \neg\psi]\}$  (where, eg.  $[\phi, \neg\psi]$  is a world where  $\phi$  is true, but  $\psi$  is false) we have the following sequence of contexts:

$$c = \{[\phi, \psi], [\phi, \neg\psi], [\neg\phi, \psi], [\neg\phi, \neg\psi]\}$$

$$+ \phi$$

$$= c' = \{[\phi, \psi], [\phi, \neg\psi]\}$$

$$+ \psi$$

$$= c'' = \{[\phi, \psi]\}$$

Returning now to *+it is raining and snow is white*, this CCP is an instruction to take a context  $c$ , and first update it with the information that it is raining, as in the transition from  $c$  to  $c'$  in (11). The instruction then specifies that this new context,  $c'$ , is to be updated with the information that snow is white:

$$12. \ c + \textit{it is raining and it is snowing} = (c + \textit{it is raining}) + \textit{it is snowing} = c' + \textit{it is snowing} = \{w \in c : \textit{it is raining in } w \textit{ and snow is white in } w\}$$

There are two important features of this update process that should be highlighted. First, note the crucial appeal to ‘intermediate contexts’ different from both the input (‘global’) context and the output context. These intermediate contexts can serve as the inputs to the CCPs of embedded sentences. Whenever a context serves as the input to the CCP of a sentence, we will call it ‘the local context’ of that sentence. In all cases, it is possible to read off the local context of an embedded sentence from the CCP of the complex sentence containing it. It will be useful to write explicitly what we mean by this:

### **Definition 2 (Local Contexts)**

Let  $\phi$  be a sentence uttered in context  $c$ , and let  $S$  be a sentence embedded in  $\phi$ . The local context for  $S$  embedded in  $\phi$  uttered in context  $c$ ,  $\mathcal{L}(S, \phi, c)$ , is that context  $c^*$  on which  $+S$  will be executed, as determined by the CCP of  $\phi$ .

For example, in our conjunction *it is raining and it is snowing*, we have: (i)  $\mathcal{L}(\textit{it is raining}, \textit{it is raining and it is snowing}, c) = c$ , (ii)  $\mathcal{L}(\textit{it is snowing}, \textit{it is raining and it is snowing}, c) = c'$ .

The second point to note is that CCPs can generally disrupt Boolean properties of logical operators.<sup>15</sup> For instance, with the case of conjunction, we no longer have commutativity: The context change potential of  $\phi \wedge \psi$  is not the same as  $\psi \wedge \phi$ , given the order dependence of update. It turns out that, in our example above ((12)), permuting the order of the conjuncts would have made no difference to the makeup of the output context. Each order would have resulted in an output context entailing that it is raining and that it is snowing. Thus, to capture the intuitively correct truth-conditions of (12), we *could* have written the CCP of  $(\phi \wedge \psi)$  as  $((c + \psi) + \phi)$ .<sup>16</sup> In addition, the dynamic framework also allows us to define a conjunction that satisfies commutativity by definition:  $c + (\phi \wedge \psi) = (c + \phi) \cap (c + \psi)$ . This entry, which would satisfy the commutativity of Boolean conjunction, would also have given us the required result for conjunctions like (12). But if all three entries would do just as well at predicting the correct truth-conditions for natural language conjunction, why have we bothered enriching the more restrictive Boolean logic that we're used to with notions of asymmetric interpretation, local contexts, and the like? As mentioned earlier, the proposed enrichments were motivated by data concerning presupposition projection (Karttunen [72], Stalnaker [125], Heim [55]). Let us turn to some of these now.

Recall that CCPs are functions from contexts to contexts. Within this framework, the CCPs of presuppositional sentences are viewed as *partial* functions, by which we mean that they are defined only on those contexts that entail their presuppositions. Thus, a sentence like *John's wife is an excellent dancer*, which presupposes that John

<sup>15</sup>For example, see the lexical entries in Heim and Kratzer [61].

<sup>16</sup>See Schlenker [107, 109, 108] for extensive discussion of this and related points.

has a wife, will have a CCP defined only on those contexts entailing the proposition that John has a wife. Here is a definition:

### **Definition 3 (Definedness of Update)**

*Let  $\phi$  be a sentence that presupposes  $X$ , and let  $c$  be a context. Then  $c + \phi$  is defined iff  $c$  entails  $X$ . When this condition is met, we will also sometimes say that  $c$  admits  $\phi$ , or, equivalently, that  $c$  satisfies the presupposition of  $\phi$ .*

It is at this point that the enrichments offered by incremental local update become important. Consider the following sentence:

13. John has a wife and his wife is an excellent dancer

Note that although (13) contains a sentence that is presuppositional (*his wife is an excellent dancer*), the conjunction as a whole does not itself inherit this presupposition (Karttunen [71]). In fact, the conjunction seems to carry no relevant presupposition at all, which, in our terminology, would mean that it should be admitted (in the sense of Definition 3) by any context whatsoever.<sup>17</sup> Imagine we are in a context where we don't know whether or not John is married. This context won't admit the second conjunct, *John's wife is an excellent dancer*, because it doesn't entail that John has a wife. However, when we evaluate (13) in this context, by the time *his wife is an excellent dancer* is evaluated, the context will have shifted to entail that John has a wife. This is because the CCP of (13) is an instruction to first update the context with the information that John has a wife,  $c + \textit{John has a wife}$ . This context now satisfies the presupposition of the second conjunct. Thus, the utility of the CCP framework is that it allows one to capture in a fairly straightforward way the fact that the information contained in the first sentence is what helps to ensure that the update of the second sentence is defined. This idea is captured by generalizing Definition 3 to embedded sentences and their local contexts:

### **Definition 4 (Local Satisfaction)**

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<sup>17</sup>Other than, perhaps, certain kinds of degenerate contexts that will receive some attention in Chapter 4.

The CCP of a complex sentence  $\phi$  is defined on context  $c$  iff  $+S$  is defined on the local context of  $S$  for each  $S$  embedded in  $\phi$ .

It is now quite easy to see that the CCP we need for  $\phi \wedge \psi$  has to be:  $\lambda c.(c + \phi) + \psi$ . Had we tried the commutative version  $((c + \phi) \cap (c + \psi))$ , we would incorrectly predict that sentence (13) should be a presupposition failure in a context where we don't know whether John is married or not. This is because  $c + \textit{John's wife is an excellent cook}$  would be undefined. Boolean conjunction's commutativity would, for the same reason, also suffer from predicting (13) to be a presupposition failure in this context.<sup>18</sup> Similar results apply for other imaginable entries, such as the other possibility we mentioned earlier,  $((c + \psi) + \phi)$ . This 'reversed conjunction' would also incorrectly predict sentence (13) to suffer from presupposition failure in the given context, because  $+ \textit{John's wife is an excellent dancer}$  would be executed on a context not entailing that John has a wife.

It is evident that the CCP framework allows the semanticist some amount of choice in deciding which of the possible space of lexical entries to define for various operators. This aspect of the system has been criticized as suffering from explanatory inadequacy (eg. Soames [121], Mats Rooth in a personal letter to Irene Heim (Heim [56]), Schlenker [107, 109, 108]). This creates quite the tension. In addition to the utility of local contexts in accounting for presupposition projection, they have been argued (eg. Heim [54]) to provide the right framework with which to account for various issues surrounding anaphora (eg. donkey anaphora, the lifespan of discourse referents, etc). They have also been found to be important in developing theories of local triviality (eg. van der Sandt [103]). They've also been argued to be important to account for various facts concerning the assertability and semantics of epistemically modalized sentences (eg. Veltman [133], van Benthem [10]). Immediately below, I will claim that Percus' facts about *Maximize Presupposition* provide a direct argument in favour of theories that employ local contexts, and constraints that are checked thereof.

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<sup>18</sup>Though, with proper pragmatic principles, this could potentially be overcome. See Stalnaker [125], Schlenker [107, 109].

What are we to make of this tension, this tension between descriptive adequacy and explanatory adequacy? Two natural responses present themselves. One is to show that the relevant facts can be developed with theories that make no reference to local contexts. The second is to try to derive the local context of any expression by use of more general principles. Philippe Schlenker has attempted to follow both alternatives. He has tried to show [107, 109] that a non-dynamic theory of presupposition can derive the same projection facts within a classical bivalent semantics along with certain general redundancy principles. But given that the utility of local contexts extends beyond presupposition, he has also attempted to derive the local context of any embedded sentence from a general ‘lazy interpretation principle’ (Schlenker [108]).<sup>19</sup> Much of what I say in the coming chapters will require the use a theory that employs local contexts. Since Schlenker seems to have not settled on any particular statement of the relevant laziness principle, for most purposes I will adopt the stipulated entries of Heim [55], for concreteness.

Returning now to MP, given the intimate connection between local contexts and the presuppositional requirements of embedded sentences, it seems quite natural within the CCP framework to imagine that MP effects might show up locally. By adopting a theory of interpretation that employs local contexts, it might be possible to return to the essential character of Standard MP, and modify it only enough to have it take advantage of the existence of local contexts. That is indeed what I propose here. Assuming that  $\phi$  is uttered in context  $c$ :

**Local MP: MP is Checked Locally** Check that MP is satisfied for each  $S$  embedded in  $\phi$  in  $S$ ’s local context  $c'$ .

To see how this formulation works, consider sentence (8). The local context for the second conjunct in the antecedent, *he assigned the same exercise to {both / all} his students*, is  $c + \text{John has exactly two students}$ .<sup>20</sup> In this context, the presupposition of *John assigned the same exercise to both his students* is met, and it indeed presupposes

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<sup>19</sup>Recent revivals of Incremental Strong Kleene systems (Fox [33], George [42]), first formulated in Peters [96], also employ related principles of lazy evaluation.

<sup>20</sup>Assuming with Heim [55] that:  $c + (\phi \rightarrow \psi) = c - ((c + \phi) - (c + \phi + \psi))$ .

more than its alternative *John assigned the same exercise to all his students*. They are equivalent in this context,<sup>21</sup> so, by MP, *John assigned the same exercise to all his students* is (locally) blocked by the presuppositionally stronger *John assigned the same exercise to both his students*. And this is what will be held accountable for the oddness of the *all* variant of the sentence. More generally, for  $\phi$  a (possibly complex) sentence uttered in context  $c$ , we simply check that MP is satisfied each time we wish to execute  $c' + S$  for each such instruction defined by the CCP of  $\phi$ . This reasoning can be extended in a very general way to all the other examples discussed above.

### 2.3.2 Some Empirical Consequences of Local MP

I believe Local MP effectively allows one to maintain the basic spirit of Standard MP. It modifies the principle only to the extent that such modifications were independently argued to be needed to account for presuppositional phenomena, viz. the checking of presupposition-related constraints in local contexts. Given this prior motivation, it would be rather unsurprising if MP should also be checked in local contexts. More important than this for evaluating the merits of Local MP as compared with Percus' Revised MP, however, is that the two principles make different predictions in certain cases. In these cases, the data side with Local MP.

First, let us consider a sentence  $\phi$  whose CCP is defined on context  $c$ , so that  $+S$  is defined in the local context  $c'$  of each  $S$  embedded in  $\phi$ . In such a case, it turns out that Local MP and Percus' Revised MP are equivalent. To see that this is so, suppose there is a  $S_j$  embedded in  $\phi$  which is a partial function (eg. suppose it's a sentence containing the word *both*). Suppose further that the local context of  $S_j$ ,  $c'$ , satisfies its presuppositions. Thus, by Local MP,  $S_j$  should be used instead of its contextually equivalent alternative  $S'_j$  (eg. a sentence that is exactly like  $S_j$  except it contains *all* at a terminal node where  $S_j$  contains *both*). Since presuppositions are everywhere satisfied (by assumption), assuming (for current purposes) that this suffices for a sentence to count as 'felicitous,' the sentence  $\phi$  containing  $S_j$  will be felicitous in  $c$ .

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<sup>21</sup>Since  $(c + \textit{John has exactly two students}) + \textit{John assigned the same exercise to both his students}$   
 $= (c + \textit{John has exactly two students}) + \textit{John assigned the same exercise to all his students}$ .

It will thus block its alternative  $\phi'$ , where  $\phi'$  is like  $\phi$  except it contains  $S'_j$  where  $\phi$  contains  $S_j$ . In other words, when presuppositions are everywhere satisfied, Local MP and Percus' Revised MP make identical predictions.

The two come apart, however, when presuppositions are not everywhere satisfied. Note that Percus makes the following prediction: one should never be able to find contextually equivalent members of the same Alternative-Family  $\phi, \psi$  that are both felicitous, for the felicity of the presuppositionally stronger one ( $\psi$ , say) should block the use of  $\phi$ . Local MP, on the other hand, is not tied to any such prediction. To see this, observe that MP simply doesn't apply if, in local context  $c'$ , the presuppositions of  $\psi$  are not met. Of course, such a state of affairs gives rise to the threat of infelicity due to presupposition failure. However, given the option of local accommodation (Heim [55]), this potential communicative catastrophe can be diverted, and  $\psi$  might still be felicitous. Here are some examples of such cases:

14. Context: It is not common ground how many bouncers there are at Club X, and any number of bouncers is possible, including none at all.

Speaker: I went to Club X last night. {A / the} mean looking bouncer at the door, the only one working that night, frisked me on my way in.

15. Context: It is not common ground how many delegates from France are at the convention. Any number could possibly be there, including none at all.

Speaker: {A / the} delegate from France isn't here because there is no delegate from France!<sup>22</sup>

To see why this is problematic for Percus' Revised MP, and not for Local MP, we must establish that the indefinite and definite conditions are contextually equivalent. Since they are obviously felicitous (no presupposition failure, no sense of MP violation), their contextual equivalence would constitute a direct counter-argument against Revised MP. Local MP, on the other hand, simply does not apply, since the

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<sup>22</sup>A modification of an example from Danny Fox, p.c.

presuppositions of the definite sentences are not met in the context of use. It thus has no say on whether the definite or indefinite should be used, and, therefore, does not predict any blocking effects between the competitors.

Please turn your attention now to example (14). Given our lexical entries for the indefinite and definite article, the indefinite and definite versions of (14) are true in the same worlds in the context set, viz. those worlds where there was a mean looking bouncer at the door, that this mean looking bouncer was the only bouncer working that night, and that this bouncer frisked the speaker on her way in. Thus, so long as the hearer is willing to accommodate that there was a mean looking bouncer at the door, the resulting output contexts of both the definite and indefinite sentence will be identical. In example (15), the indefinite case results in an output context determined by the complement of the *because* clause, namely, that there is no delegate from France (since this sentence asymmetrically entails that a delegate from France isn't here). In the definite case, where the existence presupposition of *the delegate from France* is locally accommodated (so that, in effect, negation takes wide scope over the definite), the resulting output context is the same as in the indefinite case. As a result, both (14) and (15) constitute counter-examples to Percus' Revised MP, since we've found pairs of contextually-equivalent competitors that are both felicitous in the context of use. Local MP, again, simply does not apply, and so predicts no blocking effects in these cases.

It is crucial for this analysis that Local MP be checked *before* accommodation has a chance to take place.<sup>23</sup> Local MP, much like Local Satisfaction, is a formal requirement on update processes  $+\phi$ . They both apply at each update step, and reject LFs that fail to satisfy their demands. However, we saw above that under threat of violating Local Satisfaction, the interpretive system has a repair strategy available, namely, accommodate the missing information. We are then good to ask, why can we not repair the context in such a way as to ensure that Local MP is not violated? For instance, suppose  $\phi$ ,  $\psi$  are the relevant competitors for Local MP, and suppose that  $\phi$  blocks  $\psi$ . Here is a logically possible repair strategy: Alter the local

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<sup>23</sup>Thanks to Kai von Fintel and Orin Percus for very helpful discussion of this point.

context  $c$  to a weaker context  $c' = c \cup p$  for some proposition  $p$ , where  $c'$  does not satisfy  $\phi$ 's presupposition. This would do the trick. But empirically, we just don't find such kinds of context repair taking place. Why should this be?

One initial guess might be that such a process is generally difficult due to the inherent non-determinism in the selection of  $p$ . This can't in itself explain the general lack of such repair, however, since the proviso problem for presupposition accommodation (Geurts [43]) is a positive example of non-deterministic contextual repair.<sup>24</sup> I suggest that the reason we don't find such repair lies in its non-monotonicity. For instance, consider Partee's 'bathroom sentence':

16. Either the bathroom is upstairs or there is no bathroom in the house

In what kinds of contexts can this sentence be felicitously uttered? Only those where it is not yet established whether or not the house has a bathroom. How might we account for this fact? Within a framework that employs local contexts, we can impose (following van der Sandt [103]) various *local constraints* on update that get their motivation from various 'global constraints' on assertion (Stalnaker [130]). Let us follow van der Sandt [103] and require that each local update operation  $c + \phi$  be such that: (i)  $c + \phi$  is *locally informative*, i.e.  $c + \phi \neq c$ , (ii)  $c + \phi$  is *locally consistent*, i.e.  $c + \phi \neq \emptyset$ , and (iii)  $c + \phi$  is defined.<sup>25</sup> Let us say that a context 'admits' a sentence  $\psi$  just in case constraints (i)-(iii) are satisfied for each constituent  $\phi$  embedded in  $\psi$  (in the local context  $c$  of  $\phi$ ). Now assume that the CCP for (16) looks like this:

17.  $(c + \textit{the bathroom is upstairs}) \cup (c + \textit{there is no bathroom in the house})$

If  $c$  entailed that there is a bathroom in the house, there would be a violation of local consistency at the second disjunct. On the other hand, if the context entailed that there is no bathroom in the house, there would be a violation of local informativity at the second disjunct and a violation of local definedness at the first disjunct. A simple repair process would solve both violations in each case. For instance, consider

<sup>24</sup>I come back to this issue in Chapter 4.

<sup>25</sup>See also Geurts [44], Beaver [4], Schlenker [108].

a context that entails that there is no bathroom in the house. A possible repair would be to globally add worlds to  $c$  where there is a bathroom in the house, creating a new global context  $c' = c \cup s$ , where  $s$  is some reasonable subset of worlds where there is a bathroom in the house. Once this has been done, one could execute the CCP of (16) on  $c'$  instead of on  $c$ :

$$18. (c' + \textit{the bathroom is upstairs}) \cup (c' + \textit{there is no bathroom in the house})$$

Now, given the option of local accommodation<sup>26</sup> of there being a bathroom at the first disjunct, the definedness requirement would be satisfied there, and the second disjunct would now be locally informative with respect to  $c'$ . This is what the overall update would look like:

$$19. ((c' \cap \{w : \textit{there is a bathroom in the house in } w\}) + \textit{the bathroom is upstairs}) \\ \cup (c' + \textit{there is no bathroom in the house})$$

Given the option of local accommodation, if non-monotone repairs were allowed, nothing would go wrong with the above strategy. However, we know that (16) is unassertable when it is common knowledge that there is no bathroom in the house, and it certainly cannot get you to now think it possible that there is a bathroom in the house, which is upstairs.<sup>27</sup> Since such a context does not admit (16), it suggests that non-monotonic repairs are disallowed; the only way to repair a context is by adding information, not removing information:

**Monotone Repair** The only way to repair a context is by adding information to it, never by retracting information.

The only context that admits (16), then, is one that includes both bathroom worlds and non-bathroom worlds. With local accommodation at the first disjunct, all constraints can be satisfied. It turns out that given the general availability of both local and global accommodation (Heim [55]), there are two repairs available (in principle), where  $c' = c \cap \{w : \textit{there is a bathroom in } w\}$ :

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<sup>26</sup>cf. Heim [55].

<sup>27</sup>The same goes, *mutatis mutandis*, for contexts which entail that there is a bathroom in the house.

20. Global Accommodation:  $(c' + \textit{the bathroom is upstairs}) \cup (c' + \textit{there is no bathroom in the house})$

21. Local Accommodation:  $(c' + \textit{the bathroom is upstairs}) \cup (c + \textit{there is no bathroom in the house})$

The global accommodation option is not available because  $c'$  does not admit the second disjunct (due to local inconsistency). Thus, the only possible repair is local accommodation of bathroom-worlds in the first disjunct. This is the right prediction: Partee's sentence is only assertable in a context where it is not yet common knowledge whether there's a bathroom or not, and this coincides with the fact that such a context is the only one that admits this sentence. Moreover, the output context is predicted to be one that does not entail that there's a bathroom, given that the existence of a bathroom is only locally accommodated at the first disjunct. This seems to coincide with the intuitively correct reading of the sentence: Either there's a bathroom and it's upstairs or there is no bathroom in the house.

Once we make the move from applying global constraints on speech acts to local constraints on formal update, the restriction to monotonic repair processes retains Stalnaker's [130] idealization that communication is a monotonic process of trying to figure out which of the space of possibilities is actual. Returning to the theme of Local MP, what this means is that it is not possible to change a context non-monotonically in order to rescue the update from violating Local MP. The only one of the four local constraints we've considered (Local Informativity, Consistency, Satisfaction, and MP) that can be repaired by a process of context change, then, is the constraint on Local Satisfaction. Such a repair process is called 'accommodation,' a process that we will spend some time on in Chapters 4 and 5.

Before closing this chapter, I should like to address an argument due to Uli Sauerland [104] that MP must be taken to apply globally, at the root. According to Sauerland, the use of MP as a conversational maxim gives rise to inferences he calls 'implicated presuppositions' (cf. Footnote 4, Section 2.1). For example, use of the indefinite gives rise to the inference that the presupposition of the definite does not

hold, use of *all* generates the inference that the presupposition of *both* does not hold, etc. Thus, *John submitted all his papers* gives rise to the implicated presupposition that the speaker does not believe the presupposition of *John submitted both his papers*, i.e. that the speaker does not believe that John has exactly two papers. Now consider what happens in the scope of universally quantified sentences:

22. Every candidate submitted all of his books

23. Every candidate submitted both of his books

If implicated presuppositions were generated locally, an assertion of sentence (22) should give rise to the inference that no candidate has exactly two books.<sup>28</sup> But that is obviously not the correct reading of the sentence.<sup>29</sup> If implicated presuppositions were computed globally, the inference would be that it's not the case that every candidate has exactly two books. The latter seems correct.<sup>30</sup> Now, the relation between MP and implicated presuppositions is an important one, but without getting into that here, let us ask: are these data problematic for Local MP?

First, note that under most theories of presupposition projection (eg. Karttunen and Peters [74], Heim [55], Schlenker [106]), sentence (23) presupposes that every candidate has exactly two papers. Thus, on the face of it, it should block (22) only when this condition holds, i.e. use of (22) should be felicitous only when it is not common ground that every candidate has exactly two papers. This is exactly the implicated presupposition Sauerland argues is the correct one for sentence (22). Let us see precisely how Local MP predicts this fact. In Heim's semantics, the LFs of sentences (22) and (23) would be:

24. *Every  $x_i$ ,  $x_i$  a candidate,  $x_i$  submitted all of his papers*

25. *Every  $x_i$ ,  $x_i$  a candidate,  $x_i$  submitted both of his papers*

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<sup>28</sup>Every  $x$ ,  $x$  a candidate,  $x$  not have exactly two books.

<sup>29</sup>Or, at least, if this reading is indeed available, it doesn't seem to be the preferred reading.

<sup>30</sup>Or at least preferred.

For the interpretation of variables, contexts need to be enriched from sets of worlds to sets of world-assignment pairs. The local context for  $+x_i$  *submitted all/both his papers* will be  $c' = c + x_i$  *a candidate*. By Local Satisfaction (Definition 4), the function  $+x_i$  *submitted both of his papers* will be defined only if  $c'$  entails that  $x_i$  has exactly two papers. This in turn will be met only when every individual in the domain is such that he/she has exactly two papers, since  $x_i$  will be a ‘new’ variable (Heim [53, 55, 54]). Thus,  $+x_i$  *submitted all his papers* will be blocked by Local MP only when this condition is met. As long as the context does not entail that every candidate has exactly two papers, *Every candidate submitted all his papers* will be fine by Local MP. Hence, under our notion of local checking of MP, the issue pointed out by Sauerland does not arise.



## Chapter 3

# One-Way Streets and Competition Between *only* and *exh*

This chapter focusses on restrictions on the use of Fox's [31] exhaustive operator, *exh*. I will discuss three puzzles here, all of which have the following general shape. Given independently existing constraints, we will construct sentences which, without any modification, would end up violating one or other such constraint. However, in each case, the use of an exhaustive operator would rescue the sentence from violating the relevant constraint, thus creating a pressure to insert an *exh* into the existing structure. We will see that the sentences are nevertheless infelicitous, suggesting that *exh*-insertion is not possible in such environments. At the same time, an overt *only* in all these cases is licensed, and does in fact rescue the sentence in precisely the way we would expect the exhaustive operator to. This is our general puzzle: Given that *exh* and *only* would both contribute to the meaning of a sentence in the same way relevant for obviating some or other constraint, why is *only* the only one allowed to do so?

A particularly striking feature of all the cases examined here is that the restriction on *exh* kicks in only 'downstream' in complex sentences or sequences of sentences. For instance, if there are two sentences ordered sequentially, in each case, we find the following general pattern:

- A sentence  $\phi$ , followed by a sentence  $\psi$  parsed without an exhaustive operator, is ruled out by some constraint  $C$
- If the second sentence could be parsed with an exhaustive operator,  $exh(\psi)$ , the complex sentence/sequence would be rescued from constraint  $C$
- We observe that  $\phi$ , followed by  $\psi$ , is infelicitous, suggesting that  $exh$  cannot be inserted into the second sentence
- When  $\phi$  is followed by  $only(\psi)$ , the result is felicitous
- Permuting the order of the sentences is fine, i.e.  $\psi$ , followed by  $\phi$ , is felicitous

There are two puzzles here. First, the fact that the effects show up ‘downstream,’ and only in one order, suggests that there might be something about context-change that influences which structures are allowed as the context gets updated. Second, given that *only* and *exh* would save the sentences from certain constraints in the same way, the fact that *only* can do so while *exh* cannot suggests that the two might ‘compete’ in some sense, with *only* winning the competition. I will try to convince the reader that the solution to these puzzles was already established in Chapter 2. More specifically, I will argue that the facts discussed here can be derived as effects of Local MP. As opposed to the cases discussed in Chapter 2, we will see that to tell a Local MP story for the *only/exh* facts, we will have to construe contexts as sets of world-assignment pairs  $\langle g, w \rangle$  (Heim [53, 55, 54]). Once we see that Local MP is sensitive to assignment functions, we will be able to make sense of certain other blocking effects. For example, the occasional obligatoriness of certain anaphoric elements (eg. pronouns, discourse particles like *too*) will be seen to fall out as consequences of Local MP.

If the arguments presented here are on the right track, they may have consequences for various debates in semantic theory. First, they bear directly on the debate concerning the role of local contexts and dynamic context change. This is because the arguments from this section argue for the view that assignment functions are subject

to dynamic update, and are manipulated sentence internally in the checking of constraints (eg. Local MP). Aside from this architectural debate, the chapter will make certain conclusions about the proper semantics of *only*, counterfactual conditionals, and about the theory of focus interpretation.

## 3.1 Competition Between *only* and *exh*

### 3.1.1 *only* Versus *exh* in Hurford Disjunctions

In much of the recent work on scalar implicature, a constraint discovered by Hurford [67] has been put to much use in arguing for various architectural claims about interpretation.<sup>1</sup> This constraint, so-called ‘Hurford’s Constraint’ (hf. HC), states that disjunctions  $\lceil X \text{ or } Y \rceil$  where one disjunct entails the other are infelicitous.<sup>2</sup> Call such disjunctions ‘Hurford Disjunctions.’

1. #John was born in Paris or in France.
2. #John was born in France or in Paris.

**Hurford’s Constraint** # $\lceil X \text{ or } Y \rceil$  if X and Y are Hurford Disjunctions.

Observe that although (3) and (4) are arguably Hurford Disjunctions, they are nonetheless judged felicitous:

Question: Which of John and Mary came to the party?

3. (John or Mary) or (Both John and Mary) [came to the party].
4. John or (John and Mary Both) [came to the party].

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<sup>1</sup>See especially Fox [34], Katzir [77], Singh [117], Chierchia, Fox, and Spector [17]. See also Gazdar [41] and Simons [113] for earlier discussion.

<sup>2</sup>I will just say “entailment,” but I do not mean by this ‘logical entailment;’ rather, the relevant notion here is ‘contextual entailment.’

Hurford uses the felicity of (3) along with HC to argue that English *or* is ambiguous between an inclusive and an exclusive reading. For if the first disjunct is read exclusively there is no longer any entailment between the two disjuncts. As such, HC is avoided and the sentence is judged felicitous.

Hurford's conclusion was challenged by Gazdar [41] as missing an important generalization. Gazdar argues that the obviation of HC in (3) and (4) is not a fact specific to disjunction, but rather is indicative of a more general phenomenon extending to all scalar items. More specifically, he argues that HC can be obviated anytime a (potential) scalar implicature of one of the disjuncts breaks the entailment relation. For instance, the first disjunct in (3) has an implicature which gives rise to an exclusive reading, which of course breaks the entailment with the second disjunct. Gazdar's observation is that there is nothing special about disjunction here, because the same effect is found with other scalar items, such as quantifiers:

5. John ate some of the cookies or he ate all of them.

Gazdar suggested that a disjunction can obviate HC if the weaker disjunct has a potential scalar implicature that is the negation of the stronger disjunct. However, it is important to note that for Gazdar this does not mean that a local implicature would be computed for the weaker disjunct. His system did not allow for the generation of implicatures within the scope of logical operators. This feature is problematic because, as pointed out by Chierchia, Fox, and Spector [17] (henceforth CFS), there are verifiable consequences of having to generate local implicatures in order to obviate HC. For instance, such local implicatures sometimes give rise to readings that Gazdar's system is unable to generate:<sup>3</sup>

6. Peter either solved both the first and second problems or he solved all of them.

The only available reading for this sentence can be paraphrased as 'Peter either solved only the first and second problems, or he solved all of them.' This reading cannot be produced by Gazdar's system, given that no local implicature is available

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<sup>3</sup>Example 34 in CFS.

at the first disjunct. Thus for Gazdar this sentence is predicted (incorrectly) to be equivalent to *Peter solved the first and the second problems*.

In light of these and other arguments, CFS propose that Hurford [67] was correct both in the statement of HC and in the idea that apparent violations of the constraint are obviated by ambiguity. However, rather than stipulating *lexical* ambiguities for scalar items like *or*, they propose that sentences containing scalar items (among others) manifest a systematic *structural* ambiguity. The relevant ambiguity follows quite directly from their grammatical theory of scalar implicatures.

Under their theory, implicatures are generated in arbitrarily embedded positions by use of an exhaustive operator (*exh*) in the syntax.<sup>4</sup> The meaning of *exh* is based on that of *only*. The function of both *exh* and *only* is to take a proposition, the so-called ‘prejacent’  $\phi$ , and a set of alternative propositions  $C$ , and to negate all the elements of  $C$  that are non-weaker than  $\phi$ . Formalization of the theory of implicature thus requires an explicit characterization of the set of alternatives for any given construction in any given context.<sup>5</sup>

The source of the alternatives has traditionally been thought to be quite diverse. Sentences containing scalar items have been assumed to come with a linguistically specified set of alternatives (cf. Gazdar [41], Horn [63], Sauerland [105], and Katzir [77]). For example, the grammar itself is taken to specify that *John ate some of the cookies* and *John ate all of the cookies* are alternatives to one another. Alternative sets have also been taken to sometimes be subsets of the focus alternatives (eg. Rooth

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<sup>4</sup>See also Chierchia [16], Fox [31], Fox and Hackl [35]. The meaning of *exh* is based on the semantics of *only*, differing only in that whereas *only*( $\phi$ ) presupposes  $\phi$ , *exh*( $\phi$ ) asserts it. We will assume the following semantics (ignoring presuppositions until they become relevant): Where  $C$  is a set of alternative propositions,  $\text{only}(C)(\phi)(w) = 1$  iff  $\text{exh}(C)(\phi)(w) = 1$  iff  $\phi(w) = 1 \wedge \forall \psi \in C : (\psi(w) = 1 \rightarrow (\phi \subset \psi))$ . Groenendijk and Stokhof [50], van Rooij and Schulz [98, 99], Spector [123], and Fox [31] have argued for the need to redefine these entries to ensure that they are ‘contradiction free,’ but these arguments will not bear in any important way on anything we say here. We will come back to the semantics of *exh*, and the consistency requirement, in Chapter 5, where we revise this notion of grammatical inference to take presuppositions into account.

<sup>5</sup>Of course, this holds true of any attempt at providing an explicit theory of implicature. See Fox [31] and Katzir [77] for arguments that implicatures don’t even get off the ground unless we are careful about the set of alternatives available. See especially their discussion of the so-called ‘symmetry problem,’ first discussed in Kroch [82] and given a general characterization in MIT class notes of Kai von Stechow and Irene Heim dating from the late nineties. We will have occasion to revisit the symmetry problem, and the theory of alternatives used in conversational reasoning, in Chapter 5.

[100]), as well as the denotation of the question under discussion (eg. Groenendijk and Stokhof [50], Simons [113], van Rooij and Schulz [98], Spector [122, 123], Schulz and van Rooij [110]). *C* might also include propositions that are relevant for other reasons (eg. Hirschberg [62]). We will assume for now that alternatives can come from diverse sources, and we will make certain assumptions concerning the set of alternatives for each of our examples on a case by case basis. For a fuller justification of these alternatives, please see Singh [117].

Assuming such an architecture, sentences like (5) are ambiguous between a parse with an *exh* and a parse without:

7. [[John ate some of the cookies] or [he ate all of them]]
8. [[*exh*[John ate some of the cookies]] or [he ate all of them]]

The parse in (7) violates HC, since the second disjunct entails the first. The parse in (8) escapes HC, given that the first disjunct means ‘John ate some but not all of the cookies.’ Thus, more generally it is the mechanism of local implicature generation that allows certain sentences to escape HC. Moreover, with the presence of *exh* in the logical forms of sentences, CFS are able to make precise predictions concerning the readings of various complex sentences, thereby overcoming the limitation of Gazdar’s proposal discussed above. The conclusion is that HC plus a grammatical theory of scalar implicatures provides the best account of the facts enumerated in (1)-(6).

I will assume that such a theory of implicatures is correct. I will also assume that HC is a correct characterization of the redundancy constraint.<sup>6</sup> We saw that local exhaustification saved sentences (3)-(5) from linguistic ruin. We might expect, then, that the same rescue strategy should be available if we reverse the order of the disjuncts, under the fairly standard assumption that the order of disjuncts is irrelevant to how a disjunction is interpreted.<sup>7</sup> However, this prediction seems to be

<sup>6</sup>Though see Singh [117] for arguments that the constraint needs to be strengthened in certain ways. Only those aspects of that paper directly relevant to our current discussion will be discussed.

<sup>7</sup>Certain theories of interpretation, mostly motivated by data concerning presupposition projection, are immune in principle to this prediction because they posit a non-commutative lexical entry for *or* (eg. Karttunen [72], Beaver [4], Schlenker [108]). However it is not clear to me how the proposed entries relate to the asymmetries to be discussed immediately below.

incorrect:

9. # (Both John and Mary) or (John or Mary) [came to the party]
10. # (John and Mary Both) or John [came to the party]
11. # John ate all of the cookies or he ate some of them

The puzzle generated by these sentences is this: If exhaustification can save you from HC in (3)-(5), why can't it also do so in (9)-(11)? For note that the sentences violate HC only if there is no exhaustive operator on the second disjunct. Under the assumption that the exhaustive operator is freely available, this asymmetry is surprising. It turns out that adding an overt *only* does rescue these reversed Hurford Disjunctions from falling under HC:

12. (Both John and Mary) or only(John OR Mary) [came to the party]
13. (John and Mary Both) or only JOHN came to the party
14. John ate all of the cookies or he ate only SOME of them

If both *only* and *exh* could, given their semantics, perform the function of obviating HC, why is *only* able to do so, but *exh* not? That is our first puzzle.

### 3.1.2 Modalized Conjunctions

The infelicity of the following sentence follows from fairly well-understood constraints:

15. # John and Mary came to the party and John came to the party

The oddness of this sentence seems to be related to the well-known observation that it is generally infelicitous for a conjunct to the right to be entailed by the information to its left. Here are some other examples of this kind:

16. # John has a German Shepherd, and it's a dog
17. # John lives in Paris, and he spends most of his time at his residence in France

There have been various theoretical proposals attempting to account for facts of this kind (eg. Horn [64], Stalnaker [125, 130], van der Sandt [103], Geurts [44], Singh [115], Schlenker [106, 109, 108]). Whatever the proper theoretical account of these facts, we can, for now, state the following generalization:

**No Vacuous Continuations Principle** For any sentence  $\phi$ , the conjunction  $\phi \wedge \psi$  is infelicitous if  $\phi$  entails  $\psi$ .

Returning now to example (15), we can be a bit more precise concerning its infelicity. A parse *without* an exhaustive operator would end up violating the NVCP. A parse *with* an exhaustive operator would just be contradictory, and so would be odd for the same reason that (18) is:

18. # John and Mary came to the party and only John came to the party

Thus, there is no way to parse the sentence without violating one of these constraints.

Now, consider what happens if we embed each conjunct of (18) under a possibility modal. It turns out that the sentence will no longer be contradictory. As such, in the absence of anything else working to rule out the sentence, it should be felicitous. Sure enough, we see that it is:

19. It's possible that John and Mary both came to the party and it's possible that only John came to the party

If we try the same embedding in (15), we should find that it also becomes improved. Here's why. Without an exhaustive operator anywhere on the second conjunct, the sentence would of course be ruled out by the NVCP. However, with an exhaustive operator below the possibility operator (*it is possible that exh(John came to the party)*), the sentence should be interpreted much like sentence (19). This parse would, like (19), be fine with respect to the NVCP and would, moreover, also be consistent. However, the sentence is infelicitous:

20. #It's possible that John and Mary both came to the party and it's possible that John came to the party

If we reverse the order of the conjuncts, however, the sentence becomes fine:

21. It's possible that John came to the party and it's possible that John and Mary both came to the party

The preferred reading for (21) can be paraphrased by adding an overt *only* to the first conjunct:

22. It's possible that only John came to the party and it's possible that John and Mary both came to the party

Sentence (22) is consistent and doesn't violate the NVCP, and sentence (21) tends to be read with the same meaning as (22) (i.e. with an *exh* in place of *only*). Now, our puzzle is this: If the fact that (19) is consistent, and does not violate the NVCP, suffices for it to be felicitous, why doesn't the same hold of (20) under a parallel parse with an *exh*?

### 3.1.3 Sobel and Reverse Sobel Sequences

Lewis' [85] analysis of counterfactuals brought to prominence the importance of so-called 'Sobel Sequences,' like the following:<sup>8</sup>

23. If John had come to the party, it would have been great; but if John and Mary both had come, it would have been miserable

24. If John or Mary had come to the party, it would have been great; but if John and Mary both had come to the party, it would have been miserable

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<sup>8</sup>As far as I can tell, there is no reason to restrict the discussion to counterfactuals. Indicative conditionals behave exactly the same way, eg. *If John came to the party, I'm sure it was great; but if John and Mary both came to the party, I'm sure it was miserable.*

These sequences are problematic for strict conditional theories of *if* because, under such analyses, they are predicted to be contradictory. According to such theories, a counterfactual ‘if A, would B’ is true in a world  $w$  iff all (accessible) A-worlds are also B-worlds. The set of accessible worlds is given by an accessibility function  $f: W \rightarrow \wp(W)$ . Now consider our sequences above. Take (23), for instance. The first conditional in the sequence is true iff, for every accessible world  $w'$  where John came to the party in  $w'$ , the party was great in  $w'$ . The second conditional is true iff, for every accessible world  $w^*$  where John and Mary both came to the party in  $w^*$ , the party was miserable in  $w^*$ . These two conditions cannot simultaneously be met. For instance, suppose the second conditional is true. Then all accessible worlds where John and Mary both came to the party are worlds where it was miserable. But then, that means there are accessible worlds where John came to the party where it wasn’t great, hence falsifying the first conditional. Similar remarks apply in the other direction. Given this trap, the sequence should give rise to a sense of oddness, the way other contradictory sentences do:

25. # It’s raining and it’s not raining

26. # All of the students came to the party, but some of them didn’t

But Sobel Sequences generate no oddness at all. In fact, they’re perfectly felicitous, if somewhat academic, pieces of discourse. Why are they felicitous?

At a minimum, we need to ensure that the sequences are not, in fact, contradictory. To this end, Lewis developed a modified semantics for conditionals, very much in the spirit of Stalnaker’s [124] analysis of conditionals, under which the sequences come out as semantically consistent. The crucial technical development comes in the introduction of a contextually supplied ‘similarity’ metric into the truth conditions: ‘if A, would B’ is true in  $w$  iff the *closest* A-worlds are also B-worlds. It is left to extragrammatical factors to determine the similarity/closeness ordering. What is crucial for the current discussion is that, under this account, the fact that Sobel Sequences are felicitous is no longer (necessarily) a puzzle for semantics. The sequence in (23), for example, is true in a world  $w$  iff the following conditions hold:

- the closest worlds where John came to the party are worlds where the party was great
- the closest worlds where John and Mary both came to the party are worlds where the party was miserable

Whether these conditions can be simultaneously met or not is a matter to be resolved by the similarity/closeness ordering. If it so happens that the closest worlds where John came to the party exclude those worlds where John and Mary both came to the party, then the sentence can still have a chance at being true. One is, of course, right to ask why such and such ordering can or cannot be assumed to hold in any particular case. But the important point is that, at least in principle, the felicity of Sobel Sequences can now become a headache for the psychologist or other cognitive scientist, and not for the semanticist.

A paper of Kai von Fintel's [22] teaches us that this happy conclusion needs to be rethought. He points out that although the Stalnaker-Lewis semantics allows for the felicity of Sobel Sequences, it also allows (given the identity of the truth-conditions of (23) and (27), and (24) and (28)) for the felicity of Reversed Sobel Sequences.<sup>9</sup> This prediction is incorrect:

27. # If John and Mary both had come to the party, it would have been miserable;  
but if John had come, it would have been great
28. # If John and Mary both had come to the party, it would have been miserable;  
but if John or Mary had come, it would have been great

Take (27), for instance. Its truth-conditions are stated in the bullet points just above. They are the same truth-conditions as those of sentence (23). Why the difference in felicity?

Before addressing this question, we might like to ask, given that we have evidence for the existence of embedded exhaustification, is there any reason to think that Sobel Sequences pose any difficulty in the first place? Recall that we need to ensure that

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<sup>9</sup>He attributes the observation to 1994 MIT seminar notes by Irene Heim.

Sobel Sequences are consistent (in order to account for their felicity). If the antecedent in the first conditional is parsed with an *exh*, we will have a consistent sequence. For example, the sequence in (23) would end up having the following meaning:

29. If John had come to the party but Mary didn't, it would have been great; but if John and Mary both had come, it would have been miserable

Under a strict conditional analysis along with an exhaustive operator, the sequence is no longer predicted to be inconsistent. The question then becomes, can we find evidence that there is an exhaustive operator present in the antecedent of the first conditional?

CFS (footnote 11) argue that sequences like (23) and (24) are felicitous even when it is more likely for both John and Mary to come to the party than for only one of them to come. As a result, they suggest that Sobel Sequences might actually constitute an argument for an embedded exhaustive operator. They draw a parallel case where an *exh* embedded in a DE environment would account for the felicity of a sentence that would (without *exh* result in a contradiction):

30. Every professor who fails some of the students will receive a raise; every professor who fails all of the students will be fired

Without an *exh* in the restrictor of the first sentence, the sequence would be contradictory. But it is totally felicitous, suggesting that there is an *exh* buried there. I'd like to point out in addition that if we modify the restrictor so that it does not generate the relevant implicature, the sequence is odd:

31. # Every professor who fails some or all of the students will receive a raise; every professor who fails all of the students will be fired

As expected, if we change the structures participating in the Sobel Sequence so that an account in terms of embedded implicature is unavailable, the result is odd, thus strengthening the parallel with the quantified sentences (30) and (31):

32. # If John or Mary or both John and Mary had come to the party, it would have been great; but if both John and Mary had come it would have been odd

It is not clear how a similarity-ordering based account would deal with this set of facts. First, one would have to extend the use of similarity to quantificational contexts, a move that is probably not desired. Second, we know independently that *John or Mary came to the party* has an implicature that *John or Mary or both came to the party* does not, namely, that John and Mary did not both come to the party. Employing an implicature mechanism in embedded positions thus gives us a ready account of the contrast between (24) and (32). Without a local implicature in the antecedent of the first conditional, the two antecedents denote the same proposition. Thus, the closest worlds in each case are the same, and we therefore lose any way to make sense of the contrast. I will take this as evidence that an account in terms of an embedded exhaustive operator is more likely to lead to a predictive theory of when such sequences are felicitous.<sup>10</sup> This discussion also suggests that, contra Lewis [85],

<sup>10</sup>Footnote 7 of von Stechow [22] itself discusses the possibility that exhaustification through NP focus might be relevant in these cases. He reports on evidence from David Beaver (p.c. to von Stechow) that he suggests would be problematic for an account in terms of embedded *exh*, but not for one in terms of closest worlds. For example, consider the following contrast: (1) If I had gone to the store, it would have been closed by the time I got there. But if I had run really fast to the store, it might still have been open, (2) # If I had run really fast to the store, it might still have been open by the time I got there; but if I had gone to the store, it would have been closed. With no NP to focus here, the argument is that the closest worlds account has a better grasp on these facts. What I'd like to point out here is that even with an overt *only* on the antecedent of the second counterfactual in (2), the sequence is bad: (3) # If I had run really fast to the store, it might still have been open by the time I got there; but if I had only gone to the store, it would have been closed. I believe this indicates that what is wrong with (2) is not that there is no exhaustification, but that an exhaustive operator, like *only*, can't rescue the sentence from contradiction. The reason for this, I believe, is that in (2), the alternatives for *I had gone to the store* are symmetric, perhaps including as members propositions like *I had run really fast to the store*, *I had run really slow to the store*, etc. How can we test this? We can try using certain diagnostics from Fox and Hackl [35] and Fox [34] that act as symmetry detectors. Consider the following pattern: (a) S: Did you run really fast to the store? # H: No! I only WENT to the store! (b) S: Did you have to run really fast to the store? H: No! I only had to GO to the store! (c) S: Were you allowed to run really fast to the store? # H: No! I was only allowed to GO to the store! This pattern, #*only*( $\phi$ ), *only*( $\square\phi$ ), #*only*( $\diamond\phi$ ) is the signature of symmetric alternatives; it shows that the set of alternatives to  $\phi$  is one that can't be maximized by a maximality operator like *only* or *exh* (see Fox and Hackl [35] and Fox [34] for proofs, and much discussion). Thus, we could respond to the Beaver/von Stechow data by saying that given the nature of the alternatives at the second sentence, an *exh*, like an *only*, will be of no help in escaping contradiction. Of course, this raises the question of why the alternatives should have this shape. It might be that if going to the store is relevant, and some method of going to the store (eg. running really fast) is salient, then all other methods of going to the store are automatically made relevant also. See Singh [117] for potentially related discussion.

Sobel Sequences are not problematic for the strict implication analysis of conditionals.

But what are we to make, then, of von Fintel's puzzle about reversed Sobel Sequences? The solution he offered crucially employed the Stalnaker-Lewis similarity mechanism. Given our arguments against such an approach, and in favour of one in terms of embedded exhaustification, what can we say about such data? Well, assuming a strict conditional along with an exhaustive operator, we predict that reversed Sobel Sequences should be fine. The same way that an embedded *exh* in the first conditional saves you from inconsistency, so should an embedded *exh* when the order of the conditionals is reversed. But an exhaustive operator seems to be unavailable in these positions. Interestingly enough, an overt *only* seems to do for us what an embedded *exh* cannot:

33. If John and Mary both had come to the party, it would have been miserable;  
but if only John had come, it would have been great
34. If John and Mary both had come to the party, it would have been miserable;  
but if only John OR Mary had come, it would be great

This is our third puzzle: Why is *exh* not able to rescue Reverse Sobel Sequences in the same way that *only* can?

## 3.2 Constraints on *exh*

The puzzles laid out above arise under the assumption that the exhaustive operator is freely available. They must be teaching us, then, that this assumption needs to be revised. In response to the reversed Hurford Disjunctions, and many additional complex facts concerning the availability of *exh* in DE environments, Danny Fox and Benjamin Spector [37] have provided substance to the claim that *exh* is not freely available. More specifically, they have argued for the existence of an economy condition governing the licensing of *exh* in the parse of a sentence. I will discuss this economy condition immediately below, but the basic idea is that a parse with *exh* becomes available only if the economy condition is met. They then show that for a

large class of sentences the economy condition predicts the apparent distribution of *exh*.

In this section I will motivate the need to seek out additional constraints on *exh* that are not directly captured by Fox and Spector’s economy condition. It will actually turn out that we will not have to add anything new, for I will argue that it can sometimes happen that *exh*( $\phi$ ) is blocked by a general principle, namely, Local MP. So long as we assume (as I will) that the set of alternatives for MP competitions are the scalar alternatives derived by Katzir’s [77] procedure, we would predict that *exh*( $\phi$ ) competes with *only*( $\phi$ ) under Local MP. I will propose that in some contexts the parse with *exh* is blocked by the one with *only*. The only assumptions we need are: (i) Assumptions about the semantics of *only*, borrowing from Horn and Rooth [100], (ii) A general theory of scalar alternatives (Katzir [77]), and (iii) Local MP. After discussing how this set of assumptions can solve our puzzles from above, I will hint at the generality of the approach by discussing a seemingly unrelated puzzle, namely, the fact that the discourse particle *too* is often obligatory in VP-ellipses contexts. This will give us occasion to rethink some standard assumptions about focus interpretation.

### 3.2.1 Economy and Embedded Exhaustification

For theories that employ an embedded exhaustive operator, the apparent lack of an embedded *exh* calls for some explanation. We have highlighted a class of environments where an embedded *exh* seems to be disallowed. In response to some of these puzzles, in addition to various restrictions on the availability of *exh* in DE environments, Fox and Spector [37] (henceforth FS) propose an economy condition that must be met if *exh* is to be licensed in a parse. Let me illustrate the basic idea by discussing how the economy condition solves the puzzle concerning Hurford Disjunctions. Recall that the basic contrast that needs to be accounted for is the fact that an *exh* on the first disjunct seems to rescue the sentence from Hurford’s Constraint, but not on the second disjunct:

35. (John or Mary) or (Both John and Mary) [came to the party]

36. # (Both John and Mary) or (John or Mary) [came to the party]

FS propose that the licensing of *exh* is governed by an economy condition that disallows *exh* at a point in the parse if *exh* makes no difference to the truth-conditions at that point. In other words, if adding an *exh* to constituent  $T$  makes no difference to the truth-conditions *no matter how the sentence continues after  $T$* , then *exh* cannot be used at point  $T$ . The constraint is thus a check against incremental vacuity, and it is this incremental nature of the constraint that accounts for the contrast between (35) and (36). The precise definition is the following:

**Economy Condition** Let  $S(T)$  be a sentence  $S$  that contains  $T$  as a constituent.

Then  $\#S(exh(T))$  if *exh* is incrementally vacuous in  $S$ .

To give substance to this idea, they define what it means for an occurrence of *exh* to be incrementally vacuous in  $S$ . The crucial technical definition involves a characterization of the *continuations* of a sentence at point  $T$ :<sup>11</sup>

**Incremental Vacuousness** (a) An occurrence of *exh* is *globally vacuous* in  $S$  if eliminating it doesn't change truth-conditions, i.e. if  $S(exh(T))$  is equivalent to  $S(T)$ , (b) *exh* taking  $T$  as argument is *incrementally vacuous* in sentence  $S$  if *exh* is globally vacuous for every continuation of  $S$  at point  $T$ , (c)  $S'$  is a continuation of  $S$  at point  $T$  if  $S'$  can be derived from  $S$  by replacement of constituents that follow  $T$ , (d)  $Y$  follows  $T$  if all the terminals of  $Y$  are pronounced after all the terminals of  $T$ .

Let us see how this predicts the contrast between the Hurford Disjunctions (35) and (36). An *exh* on *(John or Mary)* in (35) is globally vacuous, since '(John or Mary, but not both) or both' is equivalent to 'John or Mary or both.' However, the *exh* on this disjunct is not incrementally vacuous. This is because there are continuations

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<sup>11</sup>See Schlenker [107, 109] for applications of continuations to the theory of presupposition projection.

of the parse under which the *exh* is not globally vacuous. For instance, replace the second disjunct by *it is raining*.

An *exh* on (*John or Mary*) in (36), on the other hand, is ruled out by economy. As in (35), an *exh* on this disjunct is globally vacuous. However, it is also incrementally vacuous, since there are no continuations of the sentence (other than the trivial one, namely, the sentence itself). As a result, *exh* is disallowed in this environment. But if it is disallowed, the only remaining parse for (36) ends up violating Hurford's Constraint. There is therefore no way to properly parse the sentence.

Note that sentences (35) and (36) have the property that *exh* is globally vacuous on either disjunct. Whenever this is so, an *exh* on the first disjunct will be licensed, but the one on the second disjunct will not.<sup>12</sup> This thus accounts for the fact that other Hurford Disjunctions behave in the same way as (35) and (36), such as the quantified sentences we saw in Section 3.1.1:

37. John ate some of the cookies or he ate all of them

38. # John ate all of the cookies or he ate some of them

FS's economy condition now makes an interesting prediction. If we make additional alternatives available for (37) and (38) so that *exh* is no longer globally vacuous on either disjunct, then the bad disjunction (38) will all of a sudden become acceptable, or, at least, much improved:

39. A: Did John eat most of the cookies?

B: No. He ate all of them or he ate some of them.

More generally, the idea is that if we can create 'distant entailing disjunctions,' those disjunctions '*X or Y*' where *X* entails *Y*, but there exists an intermediate scalar alternative *Z* (where *X* entails *Z*, and *Z* entails *Y*), then an *exh* on the second disjunct should be licensed by economy. This seems to be what is behind the improvement

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<sup>12</sup>As noted above, final constituents have only one continuation, namely, the sentence itself. As a result, global vacuousness and incremental vacuousness are equivalent for final constituents.

to (38) when *most* is an alternative: An *exh* on *some* now also entails ‘not most,’ so that *all or exh(some)* is no longer equivalent to *all or some*.

Unfortunately, this prediction (that distant entailing disjunctions of the kind in (39) should be felicitous) is not always correct:

40. A: Which of John, Mary, and Sue came to the party?

B: # Either John and Mary and Sue all came or John came.

41. A: Did exactly two people with offices on the eighth floor come to the party?

B: # No. Either all of them came or Chomsky came.

I do not quite know how to reconcile these facts with FS’s economy condition. I will thus take them as indicating that there might be additional factors constraining the use of *exh*. Whatever these additional factors are, they will, like FS’s economy, have to be incremental, since (40) and (41) are fine in the reverse order:

42. A: Which of John, Mary, and Sue came to the party?

B: Either John came or John and Mary and Sue all came.

43. A: Did exactly two people with offices on the eighth floor come to the party?

B: No. Either Chomsky came or all of them came.

Further evidence that additional constraints might be required comes from the other two puzzles we introduced in Section 3.1. For instance, in our sequences of modalized conjunctions (eg. # *It’s possible that John and Mary both came to the party, and it’s possible that John came to the party*), an *exh* within the second conjunct would not be globally vacuous, and hence could not be incrementally vacuous either. Finally, in the Reverse Sobel sequences, an *exh* on the (antecedent of the) second counterfactual likewise cannot be vacuous, since the sequence without an *exh* is contradictory, while the sequence with an *exh* is not.<sup>13</sup>

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<sup>13</sup>If we consider the second counterfactual in isolation, the parse with an *exh* actually weakens the sentence, since the antecedent of a conditional is a DE environment (eg. NPI’s are licensed there). FS propose a revision to their economy condition that prevents *exh* from appearing if it is incrementally *weakening* (a sentence with *exh* cannot be entailed by a sentence without). Without

Given these prima facie difficulties for economy with the puzzles from Section 3.1, I will explore a different way of trying to account for the inability of *exh* to appear in these environments. My proposal is that *only*( $\phi$ ) and *exh*( $\phi$ ) compete under (Local) MP, and sometimes, *only*( $\phi$ ) wins. It is worth pointing out in this regard that the distant entailing disjunctions in (40) and (41), like the sentences from Section 3.1, become felicitous with *only* on the second disjunct:<sup>14</sup>

44. A: Which of John, Mary, and Sue came to the party?

B: Either John and Mary and Sue all came or only John came.

45. A: Did exactly two people with offices on the eighth floor come to the party?

B: No. Either all of them came or only Chomsky came.

As far as I can tell, we will need both the FS economy condition and my competition story if we are to account for the distribution of *exh*. The FS economy condition accounts for the incremental capacity of *exh* to obviate Hurford's Constraint, the felicity of (some) distant entailing disjunctions, and the behaviour of *exh* in DE environments, along with interactions with the placement of pitch accent. The competition story I propose can account for the puzzles I introduced in Section 3.1, as well as some additional puzzles to be discussed below. It does not account for the fact that distant entailing disjuncts can (sometimes) license *exh*, nor for the fact (not discussed here) that embedding reversed Hurford Disjunctions under universal quantifiers can rescue them (under FS's economy condition):

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getting into the details, this would suffice to prevent *exh* from appearing there. As far as I can tell, the only way to get *exh* into this environment under their revised economy condition would be with pitch accent on the scalar item. However, even with pitch accent on the scalar item, which, in subject position ensures narrow focus, Reversed Sobel Sequences are bad: # *If everyone on the eighth floor came to the party, I'm sure it was great; but if CHOMSKY came, I'm sure it was horrible.* A preference for narrow focus then might force an *only* in this environment (assuming *exh* is clausal, and is not restricted the way *only* is in terms of what it can associate with). Although I will pursue the idea that *only/exh* compete, I will not use a general preference for narrow focus to adjudicate the competition, though I do think something along these lines could go some way to explaining these facts.

<sup>14</sup>In fact adding an *only* to the second disjunct of (39) improves it, also, though I accept (39) itself as much improved when it is a distant entailing disjunction. For what it's worth, *only* does not improve Hurford Disjunctions when it is on the first disjunct. For example, *John ate only some of the cookies or he ate all of them* is not a better way of formulating *John ate some of the cookies or he ate all of them.*

46. Either everyone did both the reading and the homework or everyone did the reading or the homework

Let me now try to spell out my own proposal, and see where it leaves us.

### 3.2.2 On Competition Between *only* and *exh*

We have seen that *only* can sometimes rescue sentences from various constraints (Hurford’s Constraint, the NVCP, Consistency) in ‘downstream environments’ in a way that *exh* cannot. I would like to propose that this is because  $only(\phi)$  sometimes blocks  $exh(\phi)$ . What is the relevant principle behind this blocking effect?

The answer, I believe, comes from two sources. First, Rooth [100] argued that a structure like  $only(C)(\phi)$  comes with a certain presupposition, namely, that  $C$  is a *salient* set of alternatives including  $\phi$  and some distinct alternative  $\psi$ . This presupposition is not an idiosyncratic fact about the semantics of *only*, but rather follows from Rooth’s theory of focus interpretation. Although I have written the structure as  $only(C)(\phi)$ , the full LF is actually  $only(C)(\phi) \sim C$ , where  $\sim$  is Rooth’s focus interpretation operator.<sup>15</sup> It is this operator that introduces the presupposition about  $C$ . Since *exh* is a focus-sensitive operator,  $exh(C)(\phi)$  will share this presupposition.

In addition to these presuppositions that come from the theory of focus, Horn [65] has argued that *only* carries certain additional presuppositions:

**Horn’s Presuppositional Analysis of *only***  $only(C)(\phi)$  presupposes: (i)  $\phi$ , (ii)

That there is an alternative  $\psi \in C$ ,  $\psi$  distinct from  $\phi$ , such that  $\psi$  is more remarkable or noteworthy (i.e. less expected) than  $\phi$ .

Horn’s evidence for (i) comes from the fact that the prejacent projects through negation:

47. Not only John came to the party

Horn’s evidence for (ii) comes from contrasts like the following:

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<sup>15</sup>I will continue to write the simpler  $only(C)(\phi)$ , even though the actual structure is more complex, wherever no confusion can arise.

48. John doesn't love Mary; he only likes her

49. # John doesn't like Mary; he only loves her

I will begin by assuming Horn's analysis of *only* to be correct. Note that it is entirely consistent with Rooth's analysis, in that it strengthens the presuppositions of  $only(C)(\phi)$  that come from focus. I will also assume, as mentioned above, that the presuppositions of  $exh(C)(\phi)$  are derived entirely from the theory of focus. Finally, I will assume with Fox that  $exh(C)(\phi)$  and  $only(C)$  have the same assertive content, differing only in presuppositions (cf. footnote 4). With this as background, let's return now to our puzzles.

I'll go in reverse order, beginning with Sobel Sequences. Recall the following basic contrast:

50. If John and Mary both had come to the party, it would have been miserable;  
but if only John had come, it would have been great

51. # If John and Mary both had come to the party, it would have been miserable;  
but if John had come, it would have been great

We assume with von Fintel [22] that the local context of the antecedent of a counterfactual is a proposition, a so-called 'modal horizon,' that is constantly expanding. If the initial modal horizon is a set  $f$ , then a counterfactual updates  $f$  by adding to it a set of worlds in all of which the antecedent is true.<sup>16</sup> The local context of the antecedent of the second counterfactual, then, will be a set  $f \cup JM$ , where  $JM$  is a set of worlds in all of which John and Mary came to the party. Now if we assume that the initial modal horizon is an empty set,<sup>17</sup> the modal horizon for the second

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<sup>16</sup>For von Fintel, these will be the closest antecedent worlds. We need not make this assumption, given our earlier discussion. I also depart from von Fintel in assuming that the modal horizon is updated only with antecedent worlds, whereas he allows there to be non-antecedent worlds (so long as they're 'close enough'). My reasons for this have to do with the fact that the antecedent of an earlier counterfactual seems to suffice to satisfy the presupposition of the antecedent in a later sentence: *If John had come to the party, it would have been great; but if Mary had come too, it would have been miserable.*

<sup>17</sup>In von Fintel [22] the initial modal horizon is assumed to be a singleton set made up only of the evaluation world. As far as I can see, since all we need is an initially trivial modal horizon, the empty set would do just as well.

antecedent will be a set of worlds where John and Mary both came to the party. Thus, the prejacent of *only John* will be entailed by this context, and so the first of *only(C)(John)*'s presuppositions is satisfied. The second of its presuppositions is about the set of alternatives, *C*. Since *C* is a free variable, it gets its value from an assignment function *g*, so we have to take contexts to be sets of world-assignment pairs  $\langle g, w \rangle$ . Now, under the assumption that the proposition that John and Mary came to the party is in the set *C* with respect to which *only(C)(John)* is interpreted, then the presupposition that *C* contains a more noteworthy alternative than the prejacent is also satisfied. The assumption seems correct, since *only(John)* in this context entails 'not Mary.' The fact that 'John and Mary' was uttered in the first sentence is probably what ensures that the assignment function picks it up. We know from other cases of anaphora resolution (eg. *he, too*) that assignment functions tend to assign values to variables from formally introduced discourse entities:

- 52. If John had come to the party, it would have been great; but if he had gone to the opera instead, the party would have been terrible
- 53. If John had come to the party, it would have been great; but if Mary had come too, then it would have been terrible

Returning now to (50) and (51), we have seen that the local context of the *only* sentence in (50) satisfies all of its presuppositions. As for (51), recall that we are assuming that *exh(C)(ϕ)* carries only the presupposition that *C* contains  $\phi$  and an additional proposition  $\psi$  different from  $\phi$ . Since the presuppositional requirements of *only(C)(ϕ)* are greater than those of *exh(C)(ϕ)*, and are met in the context of use, and the two structures have the same assertive content, by Local MP, then, the *only* sentence should block the *exh* sentence, as seems to be the case.

This line of explanation extends fairly straightforwardly to the case of modalized conjunctions:

- 54. (a) It's possible that John and Mary both came to the party and it's possible that only John came to the party

(b) # It's possible that John and Mary both came to the party and it's possible that John came to the party

Recall from Chapter 2 that the CCP of conjunctive sentences  $\lceil \phi \wedge \psi \rceil$  is:  $\lambda c.(c + \phi) + \psi$ . Thus, given some  $c$ , the local context of the second conjunct is:  $c + \phi$ . In (54a,b) the local context of the second conjunct is:  $c + \diamond J \wedge M$ . To be able to run a Local MP type story, we need to answer two questions: (i) What are the presuppositions of the second conjunct in each of (54a,b)? (ii) Are the presuppositions met in their local context?

To establish the answer to (i), consider the following sentences:

55. It's possible that John has a son, and it's possible that he loves his son
56. It's possible that John doesn't have a son, and it's possible that he loves his son
57. Context: You see a man you don't know whistling at the bushes. You say to your friend:  
S: He might have lost his dog.<sup>18</sup>

Such examples argue, contra Karttunen [71], that  $\diamond \phi_p$  presupposes only  $\diamond p$ . If the projected presupposition of such sentences is indeed this weak, we are of course left with the question of why such sentences normally give rise to the inference that  $p$ . For example, we all tend to infer from *it's possible that John loves his son* that John indeed has a son. I would like to suggest that this kind of inference instantiates the well-known proviso problem, an issue to which I devote much time in Chapters 4 and 5. Putting this issue aside for now, if we are right about the projection behaviour of modalized sentences, then the second conjunct presupposes that it's possible that (John came to the party and that there is a more noteworthy alternative in  $C$ ). The fact that  $\diamond J \wedge M$  was just uttered seems to ensure that 'J and M' can serve the role of the required more noteworthy alternative, as evidenced by the fact that  $\diamond \text{Only}(\text{John})$  here means 'it's possible that John came but Mary didn't.' Moreover, the local context entails  $\diamond J \wedge M$ , hence also  $\diamond J$ . Thus the presuppositions of (54a)

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<sup>18</sup>Examples like this were first discussed, I believe, in Kay [78].

are satisfied. As a result, sentence (54b), which contributes the same new information to the local context, is blocked by Local MP.

Now what happens in the disjunctive cases?

58. (a) Either John and Mary came or only John came  
(b) # Either John and Mary came or John came

Here is what I want to say: that in the second disjunct, the sentence with *only* blocks the one without because of Local MP. In order to make this precise, I need to state what the local context of the second disjunct is, and I need to show that the presuppositions of the sentence with *only* are indeed met in that context. To the best of my knowledge there are three main competitors for what the local context of the second disjunct is. If the CCP is symmetric, so that  $c+(\phi\vee\psi) = (c+\phi)\cup(c+\psi)$ , then the local context will be the global context itself,  $c$ . But there is no way to ensure that the global context itself,  $c$ , will satisfy the presuppositions of *only John came*. For example, there is no guarantee that it will entail the prejacent, that John came. And appeals to local accommodation will not help, since, as we argued in Chapter 2, Local MP is checked before accommodation.

It has sometimes been argued (eg. Karttunen [72], Beaver [4], Schlenker [108]) that the local context of the second disjunct is actually not  $c$ , but rather  $c+\neg\phi$ . Again, there is no way to ensure that this local context would satisfy the presuppositions of the second disjunct, *Only John came*.

Another option we might consider is the following. Zimmermann [136] and Geurts [45] have argued that the LF of disjunctive sentences  $\phi\vee\psi$  is actually a modalized conjunction:  $\diamond\phi\wedge\diamond\psi$ . Such an LF, combined with the standard dynamic lexical entry for *and*, would allow us to reduce the disjunction case to the case of modalized conjunctions we discussed earlier. Unfortunately, I have doubts about the Zimmermann/Geurts analysis of disjunction. Although the analysis captures aspects of the way we interpret matrix disjunctions, it makes problematic predictions for embedded disjunctions:

59. (a) If John or Mary come to the party, it will be great

- (b) If it's possible that John comes to the party and it's possible that Mary comes to the party, it will be great
60. (a) If you mow the lawn or wash the dishes, I'll give you five dollars  
 (b) If it's possible that you (will) mow the lawn and it's possible that you (will) wash the dishes, I'll give you five dollars
61. (a) John didn't eat beef or pork at the party  
 (b) It's not the case that (it's possible that I ate beef at the party and it's possible that I ate pork at the party)

I have used *it's possible that* in the above examples, but as far as I can tell, there is no other possibility operator, and no modal base, under which the (a) sentences and the (b) sentences end up being good paraphrases of each other. This seems problematic for the proposed entry. For our current purposes, this means that for the major candidates for giving us a local context of the right kind, we are simply unable to tell the story we want to tell.

I believe that this teaches us that we were wrong about the presuppositions of *only(C)( $\phi$ )*. More specifically, I believe we were wrong in assuming that *only(C)( $\phi$ )* presupposes  $\phi$ . I am of course not alone in thinking this (eg. Horn [66], McCawley [91], von Stechow and Iatridou [27], Ippolito [68], van Rooij and Schulz [99]). I will assume instead that *only(C)( $\phi$ )* carries only the second of the presuppositions we borrowed from Horn, namely, that there is a more noteworthy alternative in  $C$ . Here are the presuppositions I will assume:

**Presuppositions of *only* and *exh*** (1) *only(C)( $\phi$ )* presupposes that there is a salient set of alternatives  $C$  containing  $\phi$  and a more noteworthy alternative  $\psi$  distinct from  $\phi$ , (2) *exh(C)( $\phi$ )* presupposes that there is a salient set of alternatives  $C$  containing  $\phi$  and an alternative  $\psi$  distinct from  $\phi$ .

Under these assumptions, the presuppositions of *only(C)( $\phi$ )* remain stronger than those of *exh(C)( $\phi$ )*, though now the entries look much more alike. I will try to justify the entry for *only* a bit later in this section by doing two things. First, I'll present

evidence suggesting that the prejacent does not behave like a presupposition. Second, I'll argue that Horn's [65] motivation for the presuppositional analysis, namely, the fact that the prejacent remains true under negation, can be derived as a scalar implicature. Before doing this, let me briefly state how these entries help us in accounting for the blocking effect.

The first thing to note is that the only remaining presuppositions are modulated by  $g$ , not by  $w$ , i.e. the structures care about what is salient, not about what is true. Thus, no matter which of the above context change potentials of disjunction (in terms of information update) turns out to be correct, all we need to assume is that the assignment function  $g$  can change by the time you get to the second member of a coordinated sentence, as seems to be the case:

62. Mary<sub>*i*</sub> came in and she<sub>*i*</sub> started yelling

63. Mary<sub>*i*</sub> either runs a lot or she<sub>*i*</sub>'s genetically gifted

Suppose we begin with an empty assignment function. The first sentence enlarges  $g$  by expanding its domain from  $dom(g)$  to  $dom(g) \cup i$ , where  $g(i) = \text{Mary}$  (Karttunen [73], Heim [53], van der Sandt [103]). Adapting the presuppositional approach to  $\phi$ -features proposed in Heim and Kratzer [61], a sentence like *she<sub>*i*</sub> started yelling* is defined in context  $c$  if and only if for every  $\langle w, g \rangle \in c$ : (i)  $i \in Dom(g)$ , (ii)  $g(i)$  is female in  $w$ . It is reasonable to suppose that  $g(i) = \text{Mary}$  will be female in all worlds in the local context of the second sentence, and so the presuppositions will be met. Thus, variables in later sentences can pick up values from entities introduced in earlier sentences.

Returning to our disjunctions (58a,b) now, by virtue of the fact that the first disjunct is *John and Mary came to the party*, I will assume that this suffices to ensure that the proposition that John and Mary came to the party is in the set of alternatives for the second disjunct in (58a) = *only(C)(John)* and (58b) = *exh(C)(John)*. As a result,  $C$  contains at least the prejacent, that John came to the party (=  $J$ ), and the alternative  $J \wedge M$ . By any plausible notion of 'noteworthy' or 'expectation,' if proposition  $p$  is logically stronger than proposition  $q$ ,  $p$  is more noteworthy/less expected

than  $q$ . Since  $J \wedge M$  asymmetrically entails  $J$ , the presupposition of  $only(C)(John)$  is met, sufficing to block  $exh(C)(John)$  by application of Local MP.

It is noteworthy, in this regard, that our revised entry for *only* not only allows our account of the Sobel Sequences and modalized conjunctions to go through, it is actually needed for the case of Sobel Sequences. For instance, consider the following slightly modified variant of the contrast in (27)/(33):

64. If John and Mary both had come to the party, it would have been fantastic; if no one had come, it would have been so embarrassing; if only John had come, it wouldn't have been too bad
65. If John and Mary both had come to the party, it would have been miserable; if no one had come, it would have been so embarrassing; # if John had come, it wouldn't have been too bad

If  $only(C)(\phi)$  presupposed the prejacent, the modal horizon of the antecedent of the final counterfactual would not satisfy its presupposition (since it contains worlds where no one came to the party, hence not John). However, with our revised entry, this is of no consequence. Since  $C$  contains a more noteworthy alternative introduced earlier, namely, that John and Mary both came to the party, this ensures that *only* has to be used in place of *exh* 'later on.'

Let me now try to present some of my reasons for rejecting the idea that  $only(C)(\phi)$  should not be taken to presuppose  $\phi$ . My main reason for skepticism comes from an objection to this analysis first presented in Shanon [111], an objection which has not, to my knowledge, been addressed. Shanon introduced a diagnostic for distinguishing presuppositions from assertions. The diagnostic, developed in greater detail by Kai von Stechow [23], has it that if sentence  $S$  presupposes  $p$ , the hearer can respond: *Hey wait a minute! I didn't know that p!*<sup>19</sup>

66. S: It surprised me that it was raining in Chicago.

H: Hey wait a minute! I didn't know it was raining in Chicago!

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<sup>19</sup>We will have occasion to examine this conversational move in much greater detail in Chapters 4 and 5.

67. S: I'm sorry I'm late. I had to pick up my sister from the airport.

H: Hey wait a minute! I didn't know you have a sister!

Given this diagnostic, the so-called *Hey wait a minute! test* (henceforth HWAMT), it turns out that it is not possible to perform a HWAM! objection to the prejacent of *only*:

68. S: Only John came to the party.

H: # Hey wait a minute! I didn't know John came to the party!

Given that it seems to always be possible to HWAM the presupposition of the sentence, the fact that you cannot HWAM the prejacent constitutes a fairly solid argument against the idea that *only*( $\phi$ ) presupposes  $\phi$ .

And there are other reasons to be skeptical. For example, consider the following pair of sentences:

69. (a) Only John has a sister

(b) John's sister will pick him up from the airport

Both sentences entail that John has a sister. If we also take them both to presuppose that John has a sister, then it becomes something of a mystery why John having a sister seems to survive embedding under *it's possible that only* in (70b):<sup>20</sup>

70. (a) It's possible that only John has a sister

(b) It's possible that John's sister will pick him up from the airport

Moreover, von Stechow [21] argues that it's quite odd to explicitly express ignorance of a proposition, and then use a sentence that presuppose it:

71. # I don't know whether the typewriter was broken or not, but if it was Sam who broke it, I'll be mad

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<sup>20</sup>Recall (eg. *it's possible that John lives his son*) that stand-alone modal sentences containing a presuppositional sentence tend to let through the presuppositions of the embedded sentence (Karttunen [71]).

It turns out, again, that the prejacent of *only* does not behave in this way:

72. (a) I don't know whether anyone here (including John) has a sister or not, but if only John has a sister, I'll be really disappointed  
(b) # I don't know whether anyone here (including John) has a sister or not, but if John's sister will pick him up from the airport, I'll be really disappointed

There are many other arguments against the idea that  $only(C)(\phi)$  presupposes  $\phi$  (eg. Horn [66], von Stechow and Iatridou [27], Ippolito [68], van Rooij and Schulz [99]). I will leave for future occasion an engagement with some of the proposals developed in these articles. For now, I would like to suggest a way in which my proposed revision to Horn's [65] analysis can be made consistent with the fact that  $\neg(only(\phi))$  still implies  $\phi$ . Recall (eg. (47)) that Horn used this as an argument in favour of his presuppositional analysis. We are rejecting this assumption. But if the following sentence does not presuppose that John ate some of the cookies, why do we infer from it that he did?

73. John didn't eat only SOME of the cookies

I would like to suggest that this inference follows as an implicature of the sentence. To make the argument, I rely on Fox and Spector's recent work (FS, [37]) on embedded exhaustification. They argue that the following sentence, without *only*, has an exhaustive operator under negation:

74. John didn't eat SOME of the cookies

But with the logical structure  $\neg(exh(some))$ , we would expect the sentence to mean that John either ate none of the cookies or he ate all of them.<sup>21</sup> However, they argue that the sentence actually means something else, namely, that John ate all of the cookies:

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<sup>21</sup>The embedded proposition would be that John ate some but not all of the cookies. This is what gets negated.

75. (a) John didn't eat SOME of the cookies; he ate all of them!  
 (b) # John didn't eat SOME of the cookies; he either ate all of them or he didn't eat any of them!  
 (c) # John didn't eat SOME of the cookies; he didn't eat any of them!

How does this come about? FS propose that there is an exhaustive operator above negation as well, so that the structure is actually:  $exh(\neg(exh(some)))$ . More specifically, the structure is:  $exh(C_2)(\neg(exh(C_1)(some)))$ . They offer a general theory of alternatives under which  $C_1 = \{some, all\}$ , and  $C_2 = \{\neg some\}$ . I will not review these arguments here, and refer the reader to FS for details. What is important to note is that with these values for  $C_1$  and  $C_2$ , the structure  $exh(C_2)(\neg(exh(C_1)(some)))$  ends up meaning John ate all of the cookies.

With this result in hand, let us return to the question of why (73) entails that John ate some of the cookies. First, with focus on *some*, the embedded sentence is actually parsed as  $only(C_1)(some)$ , where  $C_1 = \{some, all\}$ . With an *exh* outside negation, we have the following parse:  $exh(C_2)(\neg(only(C_1)(some)))$ . Under FS's theory of alternatives,  $C_2 = \{\neg some\}$ . As before, this structure ends up meaning that John ate all of the cookies, which entails that John ate some of the cookies:

76. (a) John didn't eat only SOME of the cookies; he ate all of them!  
 (b) # John didn't eat only some of the cookies; he didn't eat any of them!

Thus, contra Horn [65], I believe the inference to the prejacent under negation follows from implicature, not presupposition. However, under my analysis, the prejacent does not (contra McCawley [91], Ippolito [68], van Rooij and Schulz [99]) follow as an implicature when  $only(\phi)$  is unembedded. Rather, it is asserted. I have proposed an entry for *only* under which  $only(C)(\phi)$  presupposes that there is a more noteworthy member  $\psi$  in  $C$ , and asserts that  $\phi$  is the strongest member of  $C$  that is true. I think that this entry can help make sense of some further puzzling facts. Consider again the case of disjunctions  $X \vee Y$ . Suppose that the two disjuncts have no natural expectation order. Suppose that we wish to add an *only* to the second disjunct. If  $C = \{X, Y\}$ , say, we might expect that adding an overt *only* to the

second disjunct would result in presupposition failure, since the presupposition that there is a more noteworthy alternative would not be satisfied. However, when there is a natural order, with  $X$  ‘better’ than  $Y$ , an *only* should work fine. This is indeed what we seem to find:

77. A: Tell me about John.

- (a) B: He either loves Mary or he likes parsing the WSJ
- (b) B: # He either loves Mary or he only likes parsing the WSJ
- (c) B: He either loves Mary or he only likes her

78. A: Who came to the party?

- (a) B: Either John or Mary
- (b) B: # Either John or only Mary
- (c) B: Either Noam Chomsky or only Jacques Derrida

Note that there is no obvious reason why the (b) sentences should be odd. If the (a) sentences can be parsed with an *exh* on each disjunct, there is no obvious reason why the (b) sentences shouldn’t be parsable with an *only* on the second disjunct. However, our analysis provides a ready explanation for these facts. For example, if *John came to the party* is the only salient alternative to *Mary came to the party*, then, since there is no reason (logical or otherwise) to think it more noteworthy, there is no reason to use *only*. Doing so would amount to a presupposition failure.

Let me briefly summarize the discussion of this chapter so far:

- I argued that various constraints (Hurford’s Constraint, the NVCP, Consistency Requirements) can be obviated by embedded *exh*, but that this capacity is sensitive to the left-right order of a sentence/sequence
- I argued that Fox and Spector’s economy condition will need to be supplemented if we are to capture the full distribution of *exh*
- I proposed an entry for  $only(C)(\phi)$  under which it presupposes that there is a more noteworthy alternative, asserts the same thing as  $exh(C)(\phi)$ , and where

the inference to  $\phi$  under negation follows from exhaustification, not presupposition

- I argued that the inability of *exh* to obviate some of the constraints is due to the fact that  $only(C)(\phi)$  and  $exh(C)(\phi)$  compete under Local MP, and that sometimes,  $only(C)(\phi)$  wins
- I argued that once *exh* is assumed, Sobel Sequences do not (contra Lewis [85]) provide an argument against a strict implication analysis of conditionals
- that properties of what is and is not salient, and changing assignment functions, play a crucial role in the explanation of presuppositional blocking effects

I would like to spend the rest of this chapter focussing on the last point. In much of the recent discussion on dynamically changing contexts, the importance of salience and dynamically changing assignment functions has not received adequate attention. In Chapter 2 we discussed the need for local contexts in accounting for Percus' facts. There we looked only at contexts construed as propositions, sets of worlds. Here, we have seen that with contexts construed as sets of world-assignment pairs, Local MP helps us account for various puzzling facts once the presuppositional requirements on assignment functions are taken into account. And here, also, the assignment functions relevant for evaluation have changed during interpretation. I'd like to point out a couple of further applications of the idea that, with contexts construed as sets of world-assignment pairs, Local MP can capture various otherwise puzzling facts. This class of arguments bolsters the argument in favour of local contexts. In addition, I believe it provides a set of analytic tools that might help shed light on related domains.

### 3.3 Dynamically Changing Assignment Functions

#### 3.3.1 Discourse Referents

Consider the following contrasts:

79. (a) A man<sub>*i*</sub> came in, and # a man<sub>*i*</sub> started yawning.  
 (b) A man<sub>*i*</sub> came in, and he<sub>*i*</sub> started yawning.
80. (a) # He<sub>*i*</sub> came in, and a man<sub>*i*</sub> started yawning.  
 (b) He<sub>*i*</sub> came in, and he<sub>*i*</sub> started yawning.

Consider first the contrast in (79). Heim [53, 55, 54] has a straightforward account of this case. She posits a Novelty/Familiarity Condition which states something like the following:

**Novelty/Familiarity Condition** Let  $g$  be an assignment function, and let  $p$  be an atomic formula containing noun phrase  $NP_i$ . Then if  $NP_i$  is definite,  $i$  must be in  $dom(g)$ , and if  $NP_i$  is indefinite,  $i$  must not be in  $dom(g)$ .

Applied to (79), we can see that (79a) amounts to a violation of the condition, since at the second conjunct,  $i$  is in  $dom(g)$ , given the first conjunct.<sup>22</sup> Sentence (79b), on the other hand, involves no such violation, and so is judged felicitous.

When Local MP is assumed, however, we can simplify the Novelty/Familiarity Condition by eliminating the constraint on indefinites. Thus, we can assume that a sentence like *a man<sub>*i*</sub> started yawning* has no definedness condition at all. A sentence like *he<sub>*i*</sub> started yawning*, on the other hand, is defined only if for every  $\langle w, g \rangle \in c$ : (i)  $i \in Dom(g)$ , (ii)  $g(i)$  is male in  $w$ . Since both update the context in the same way (by adding the information that  $g(i)$  started yawning), by Local MP, you're forced to use the pronominal variant (b) instead of (a). Thus, the infelicity of (a) falls out as a violation of Local MP, rather than the Novelty/Familiarity Condition.

Turning to (80a), one account of its oddness would come from the application of Local MP at the second conjunct. Given that there's already a discourse referent  $i$  in the context, the use of *a man<sub>*i*</sub>* should be blocked by *he<sub>*i*</sub>*. An alternative account would have it that the problem comes at the first conjunct, where there might be presupposition failure due to the presuppositional requirements of *he<sub>*i*</sub>* not being met there. However, given the felicity of (80b), it is clear that this is not the source of the

<sup>22</sup>In Heim's semantics, indefinites like *a man<sub>*i*</sub>* update  $g$  by expanding its domain to  $dom(g) \cup \{i\}$ .

oddness. One can readily accommodate a new file card  $i$  containing the information that  $g(i)$  is male. For instance, (80b) could easily be the first line of a novel. There is no way for (80a) to enjoy such a status. Thus, Local MP seems to be the only account of these facts. If so, we might consider using it to motivate a semantics for proper names under which the following facts, which seem to be rather similar to the above, fall out as theorems of Local MP:

81. (a) John<sub>*i*</sub> came in and he<sub>*i*</sub> started yelling  
 (b) # He<sub>*i*</sub> came in and John<sub>*i*</sub> started yelling

### 3.3.2 VP-Deletion, Competing Structures, and Focus Interpretation

It has long been observed that *too* (among other discourse particles) is often obligatory in certain contexts (eg. Green [46, 47], Kaplan [69], Krifka [80], Zeevat [135], Sæbø[102], Amsili and Beyssade [3]). Consider, as a special case, VP-deletion contexts:

82. John came to the store, and Bill did too  
 83. # John came to the store, and Bill did

One thing to note immediately is that the effect appears in arbitrarily embedded contexts, below the level of speech act:

84. If John came to the store and Bill did too, then Mary will be quite pleased  
 85. #If John came to the store and Bill did, then Mary will be quite pleased  
 86. (Either John came to the store and Bill did too) or Mary doesn't know what she's talking about  
 87. #(Either John came to the store and Bill did) or Mary doesn't know what she's talking about

88. Sue believes that John likes Mary and Bill does too

89. #Sue believes that John likes Mary and Bill does

The same asymmetry has also been noted with respect to certain ACD constructions. For example, Pesetsky [95] notes that the infelicity of (90), noted by May [89], is eliminated by insertion of *also*:

90. \*Dulles suspected Philby, who Angleton did

91. Dullies suspected Philby, who Angleton also did

The question is: why?

In a footnote, Pesetsky attributes the following suggestion to Kai von Fintel (p.c. to Pesetsky).<sup>23</sup> The suggestion is that this contrast might be related to an observation von Fintel attributes to Irene Heim (p.c. to him), one we've come across already in a slightly different form. Imagine you have a guest over at your place. You can of course offer her a cup of coffee by asking, *Would you like a cup of coffee?* If the guest finishes her cup, and you want to offer her another, you cannot do so by asking, # *Do you want a cup of coffee?* You have to ask, *Do you want another cup of coffee?* This is exactly a *Maximize Presupposition!* effect, where the sentence with *another* blocks the alternative with the indefinite article, since it asks the same question (whether the guest wants a cup of coffee), but presupposes something stronger (that the guest already had a cup of coffee). The suggestion that Pesetsky attributes to von Fintel is that the sentences with *too* block the ones without because they carry stronger presuppositions. Amsili and Beyssade [3] follow this suggestion and attempt to use it to derive the obligatoriness of *too* in these and other environments.

The reader will have noted that, as it stands, this account faces at least two difficulties.<sup>24</sup> First, in the relevant constructions, the sentences are all presuppositionless. For example, focussing now on the basic contrast in (82) and (83), neither sentence

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<sup>23</sup>FN. 32 of Pesetsky [95].

<sup>24</sup>There are actually three. Irene Heim points out to me (p.c.) that *too* is not exactly obligatory. The right pronunciation can obviate the obligatoriness. I will not have anything to say about this here, though I hope the line of analysis can be made consistent with this fact.

carries any presupposition. Sentence (82) contains a constituent, *Bill did [come to the store] too*, which does carry a presupposition (roughly, that there is some salient individual different from John who came to the store). But this presupposition is not inherited by the sentence as a whole, given the projection properties of conjunctive sentences. These cases are thus exactly like the Percus examples we saw in Section 2.2. The solution to them, should we wish to follow von Stechow's intuition, is to use Local MP. It is not that (82) blocks (83), but that, once we are in context  $c+$  *John came to the store*, then *Bill did too* blocks *Bill did*, presumably because the former carries a stronger presupposition than the latter.

This brings me to the second difficulty. What does it mean to say that *Bill did too* presupposes something stronger than *Bill did* in its local context? What *are* the presuppositions of these sentences, and how do they relate to a general theory of VP deletion? Moreover, since I am assuming that the alternatives for MP are generally scalar alternatives, we expect that a structure  $\phi$  can be blocked only by a competing structure that is no more complex than  $\phi$ . But in the examples of interest, *Bill did too* seems to be strictly more complex than *Bill did*, given the extra discourse particle *too*.

My goal in this section is extremely modest. For the restricted case of VP-deletion, I wish to spell out some of the assumptions that need to be made in order to make an account along the lines of von Stechow's suggestion to Pesetsky work out. I will not be comprehensive, and will not engage in debates with the literature on this topic. I only wish to explore the nature of the assumptions that might be needed to formulate such a proposal within a general theory of VP-ellipsis. I will follow an approach to ellipsis outlined in Heim [59], which itself depends on Rooth's [100] theory of focus interpretation. Let me begin with the latter.

Rooth [100] assumes that focus is syntactically represented, so that the LF of a sentence like *JOHN came to the store* (pitch accent on *John*) is:  $\phi = [\text{John}_F \text{ [came to the store]}]$ . The focus semantic value of  $\phi$ ,  $[[\phi]]^F$ , is:  $[[\phi]]^F = \{x \text{ came to the store: } x \text{ an individual}\}$ . This is an awfully big set, and focus effects usually show up only with highly restricted subsets  $\Gamma$ , or particular members  $\gamma$ , of this set. To capture

this, Rooth offers the following as the main principle governing the interpretation of focus:

**Focus Interpretation Principle** In interpreting focus at the level of phrase  $\phi$ , add a constraint that: (i)  $\Gamma \subseteq [[\phi]]^F$ , or (ii)  $\gamma \in [[\phi]]^F$ , where  $\Gamma$  is a variable with the type of a set of objects each of which matches  $\phi$  in type, and  $\gamma$  is a variable matching  $\phi$  in type.

Focus-sensitive semantic effects will be limited to either  $\Gamma$  or  $\gamma$ , a subset or member of the focus semantic value of  $\phi$ , and it will be up to the context to determine the values of these variables. Rooth formalizes this context-dependency by introducing a squiggle operator  $\sim$  to LFs. The function of this operator is to introduce the above constraints as presuppositions. Thus, the LF of *JOHN came to the store* would actually be one of: (i)  $[\text{John}_F \text{ [came to the store] } \sim \Gamma$ , or (ii)  $[\text{John}_F \text{ [came to the store] } \sim \gamma$ . Rooth argues that these LFs have additional presuppositions about  $\Gamma/\gamma$ . Here is the full statement of the presuppositional constraints on LFs containing the squiggle operator:

**Presuppositional Constraints Introduced by the Squiggle** (i) **Set Case:**  $\phi \sim \Gamma$  presupposes that  $\Gamma$  is a subset of  $[[\phi]]^F$ , and contains both  $[[\phi]]$  and an element distinct from  $[[\phi]]$ , (ii) **Individual Case:**  $\phi \sim \gamma$  presupposes that  $\gamma$  is an element of  $[[\phi]]^F$  distinct from  $[[\phi]]$ .

Now we need to say something about VP-deletion. Here I will follow Heim [59]. First, we need to define a notion of *appropriate contrast*:

**Appropriate Contrast** An LF  $\psi$  *contrasts appropriately* with LF  $\phi$  iff: (i)  $\phi$  is distinct from  $\psi$ , (ii)  $[[\phi]] \in [[\psi]]^F$ , i.e.  $\phi$  is an element of the focus semantic value of  $\psi$ .

With this definition, the following condition is imposed on the licensing of VP-deletion:

**Licensing VP-Deletion** A VP can be deleted if it is contained in a phrase that contrasts appropriately with some phrase that contains the antecedent VP.

So far, I have introduced some fairly uncontroversial assumptions from focus semantics and VP-ellipsis. Note that, already, these assumptions potentially give us a handle on a concern I raised earlier about the complexity of the alternatives involved. For note that whatever the precise structure assigned to *BILL did too*, the LF of *BILL did* will have more complexity than the phonology reveals, since there will be a squiggle operator appended to it. Here is the LF of (83):

92. [ $PAST$ [John come to the store]]<sub>7</sub>, and [ $PAST$ [[Bill]<sub>F</sub> came to the store]]<sub>~7</sub>

The above LF satisfies the appropriate contrast condition, and so receives the phonology indicated in (83). But why is it odd, if it satisfies the relevant condition? If we want to follow von Stechow's intuition and extend (Local) MP to account for this fact, we seem to be forced to say that the oddness comes because it is blocked by the following structure, which we take to be the LF of (82):

93. [ $PAST$ [John come to the store]]<sub>7</sub>, and [ $PAST$ [[Bill]<sub>F</sub> came to the store]]<sub>too7</sub>

In other words, the parse with a squiggle operator must be competing with a parse with *too*. Note that the structure in (93) satisfies the appropriate contrast condition, and so licenses deletion of the VP. But the reader will no doubt have noticed that (93) contains no squiggle operator of its own. Is this problematic, given that  $\sim$  is what interprets focus? We will see. For now, I have to make this assumption to ensure that the competitors are of equal complexity. To run a Local MP story here, I also need to ensure that the second sentence in (93) carries stronger presuppositions than its variant in (92). Modelled after Kripke [81] and Heim [58], I propose the following entry.<sup>25</sup>

**Definition 5 (Definedness Conditions of *too*)**

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<sup>25</sup>Note that Kripke and Heim envision *too* as being anaphoric to the subject of the first sentence (when there is focus on the subject), not the entire clause. I have made this modification because it will make it easier for me to state the relevant competition principles.

Let  $\phi \text{ too}_i$  be an LF, with  $\text{too}$  co-indexed with LF  $\psi_i$ . Then  $c + \phi \text{ too}_i$  is defined iff:  
 (a)  $[[\psi]] \neq [[\phi]]$ , (b)  $[[\psi]] \in [[\phi]]^F$ , (c)  $c + \psi = c$  (i.e.  $\psi$  is true in  $c$ ).

This is enough for us to use Local MP to account for the blocking effect. The reason for this is that (92) only includes (a) and (b) as part of its definedness condition (cf. the definition, *Presuppositions Introduced by Squiggle*, just above), while (93) has the additional presupposition in (c) that  $\psi$  be true. In our example, this would be the presupposition that John did, in fact, come to the store.

But have we now distorted Rooth's theory of focus interpretation? Rooth states the theory of focus as consisting of the following components:

**Rooth's Theory of Focus** The theory of focus consists of: (a) Rules describing the phonological interpretation of the focus feature  $F$ , (b) Two-dimensional alternative semantics, defining focus semantic values with reference to  $F$  and ordinary semantic values, (c) The semantic clauses for the squiggle operator  $\sim$ , (d) The rule introducing  $\sim$  in LF

What I am contemplating is allowing the existence of focus interpretation operators other than  $\sim$ . For example, the set of focus interpretation operators **FIO** would include at least the following as a subset:  $\{\sim, \text{too}\}$ . Each such focus interpretation operator would obey the schema outlined in the Focus Interpretation Principle and, more generally, would include at least the presuppositions currently assigned to the squiggle operator  $\sim$ :

### **Presuppositional Constraints Introduced by Focus Interpretation Operators**

Let  $O$  be a Focus Interpretation Operator. Then: (i) **Set Case**  $\phi O \Gamma$  presupposes that  $\Gamma$  is a subset of  $[[\alpha]]^F$ , and contains both  $[[\alpha]]$  and an element distinct from  $[[\alpha]]$ , (ii) **Individual Case**  $\phi O \gamma$  presupposes that  $\gamma$  is an element of  $[[\alpha]]^F$  distinct from  $[[\alpha]]$ .

In addition to this, different FIO's may or may not bring additional presuppositional statements. However, it is important to note that focus effects would still be

derived as theorems of Rooth’s theory. The only modification would be the inclusion of a set of FIO’s in addition to the squiggle. Thus, the change to the theory would consist of a modification to axiom (c): The semantic clauses would not be for  $\sim$ , but for any FIO  $O$  (invariant across the members of  $O$ ). And, within the set **FIO**, variation would be limited to only arbitrary properties of the phonology and the semantics, but would make no reference to focus. For instance, our entry for *too* differs from the entry for  $\sim$  only in that it is overly realized and it carries an additional presupposition. There are no stipulations related to focus, other than that it is an FIO, as with  $\sim$ .

If this much is accepted, we might contemplate expanding **FIO** to include more items:  $\{\sim, \text{too}, \text{only}, \text{even}, \text{again}, \text{still}, \text{exh}, \dots\}$ .<sup>26</sup> This would require a modification to the LFs assumed by Rooth. For instance, a sentence like *only JOHN came to the party* would have LF  $\text{only}(\Gamma)(\phi)$ , instead of Rooth’s  $\text{only}(\Gamma)(\phi) \sim \Gamma$ . Our definedness condition for such an LF would then be forced (by the schema for all FIO’s) to include the presuppositions introduced by clause (i) of the general schema (the set case). However, since we allow FIO’s to encode phonological/semantic properties not dictated by the theory of focus, the entry for *only* could carry stronger presuppositions without distorting the general schema. Following our discussion from Section 3.2.2, the lexical entry for *only* would include a presuppositional statement that there is a more noteworthy member in  $\Gamma$ . Such an LF would be defined, then, iff: (a)  $\Gamma$  is a subset of  $[[\alpha]]^F$ , (b)  $\Gamma$  contains both  $[[\alpha]]$  and an element distinct from  $[[\alpha]]$ , (c)  $\Gamma$  contains a more noteworthy/less expected proposition. The exhaustive operator *exh* would be identical to *only* except that it would lack the presupposition (c). Note that this schema would also help to bring out the close relation between *only* and *even* pointed out by Horn. The definedness condition of  $\text{even}(\Gamma)(\phi)$  would share presuppositions (a) and (b) with *only*, but would differ along (c), where its expectation-based presupposition would be that  $\phi$  is the least likely member of  $\Gamma$  to be true.<sup>27</sup> It

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<sup>26</sup>Though see Beaver and Clark [7] for arguments that not all focus sensitive operators can be treated uniformly.

<sup>27</sup>Thanks to Danny Fox (p.c.) and Roni Katzir (p.c.) for bringing the *only-even* relation to my attention.

would also have a different assertive component.

These suggestions about the theory of focus require much more justification than can be provided at this point. My goal here was to show that once we adopt Local MP as a descriptive device, it has the potential to shed light on various other issues in semantic theory. I wished to at least outline in rough detail one such potential line of development here.



# Chapter 4

## The Proviso Problem

The concept of presupposition has given rise to many research questions of both a technical and conceptual sort. How do presuppositions arise? What is their epistemic status? Is the class of presupposition triggers a unified set? How do compositional semantic mechanisms interact with pragmatic reasoning to give rise to presuppositional inferences? This chapter will focus on a specific version of the latter question, the so-called ‘proviso problem’ (Geurts [43]). Following Beaver [4, 6], von Stechow [25], and Heim [60] I will state the problem as one concerning the relation between presupposition projection (the compositionality problem for presuppositions) and presupposition accommodation (the pragmatics of contextual repairs in response to the threat of presupposition failure). By carving presuppositional phenomena into ‘projection’ and ‘accommodation,’ I bring along various theoretical commitments. I will try to be clear on what exactly these commitments are, for doing so will help clarify what exactly the proviso problem is a problem about. A precise statement of the problem should, in turn, help guide us in the search for a solution.

I have said that I will be concerned with the relation between projection and accommodation. Let me state very roughly what I mean by these terms:

**Presupposition Projection** Under the assumption that we can associate presuppositions with atomic sentences, can we characterize a mechanism that would predict the presuppositions of complex sentences based on the presuppositions

of their atomic parts?

**Presupposition Accommodation** Suppose the mechanism tells us that the projected presupposition of sentence  $\phi$  is proposition  $p$ . Let us interpret this to mean (with Karttunen [72] and Stalnaker [125], and much scholarship since) that the use of  $\phi$  in context  $c$  requires that  $c$  already entail  $p$ . When this condition is not met, it is known that we can sometimes ‘repair’  $c$  by adding some proposition  $p'$  to  $c$  so that the resulting context  $c' = c \cap p'$  will then entail  $p$ . Is there any reason to think that a theory of semantic competence should care about this process? If so, can we provide an explicit characterization of this process?

Karttunen [71] unearthed a complex set of facts concerning presupposition projection which, for the most part, continue to defy a general solution. These facts led Karttunen [71] and Karttunen and Peters [74] to introduce a component of the grammar specifically devoted to presupposition projection. This projection component introduced a second dimension into interpretation, working separately from the compositional system responsible for assigning truth-conditions to logical forms. Karttunen [72], Stalnaker [125], and Heim [55] proposed an alternative approach, the so-called ‘satisfaction theory’, that purported to eliminate the need for multidimensionality. The foundational idea shared by these papers is that by taking the dynamics of context change seriously, we might be able to do away with having to postulate a component of the grammar dedicated to presupposition projection. In a slightly different way, this architectural viewpoint also guided Gazdar’s [41] treatise on pragmatic theory. It has also given rise to somewhat related representational theories of context change (eg. van der Sandt [103], Geurts [44]). On the other hand, it has been charged with actually smuggling in a projection component without noticing that it had done so (Soames [121], Mats Rooth in a personal letter to Irene Heim [56]). Only now, decades later, has this issue been raised again, with attempts to address the difficulties involved (Schlenker [107, 109, 108], Fox [33], George [42], LaCasse [83]). It is this context-change family of approaches to presupposition that will be the focus

of this chapter. The particular instantiation I will assume is that of Heim [55], as introduced briefly in Chapter 2. I will discuss related and competing theories as they become relevant.

I will assume (in order to state clearly what the proviso problem is) that the satisfaction theory's predictions about projection are correct. As such, I am bound to its commitments concerning the relation between a sentence's projected presupposition (a matter for grammar) and appropriacy conditions on the use of the sentence (a matter for pragmatics). In particular, I am committed to the following idea: If sentence  $\phi$  presupposes proposition  $p$  (as determined by the theory's solution to the projection problem), then proper use of  $\phi$  in context  $c$  requires that  $c$  entail  $p$ . There are at least two respects in which this commitment is not as straightforward as one perhaps would like.

First, this condition on appropriate use seems to be too strong since it is a fairly trivial matter to find cases where the sentence can be used even when  $c$  does not entail  $p$ . The prominent response to this difficulty has been to admit into the theory an additional process of 'accommodation,' whereby the hearer, if charitable enough, can enrich the context so as to meet the required condition (eg. Karttunen [72], Stalnaker [125, 128, 129], Lewis [86], Beaver [4], Beaver and Zeevat [9], von Stechow [25], and much other work). This response has come under fire for not doing justice to the way most conversations work (eg. Gazdar [41], Burton-Roberts [13], Gauker [40], Abbott [1], Thomason et al. [131]). Upon closer inspection, we will see that the satisfaction theory is the only one that is able to make proper sense of certain conversational moves discussed by Shanon [111] and von Stechow [24]. These arguments will imply: (i) that presuppositions have to be construed as constraints on the context, and (ii) that cases where the constraints seem to not be met teach us that there is in fact a process of accommodation that can sometimes kick in to rescue the dialogue.

This leads directly to the second problem. It has been argued (Geurts [43, 44]) that even if we grant the existence of a process of accommodation, the theory remains stuck with insurmountable difficulties. In its strongest form, the argument is that there is no possible theory of accommodation which, in conjunction with the satisfaction theory's

predictions about projection, would suffice to capture a certain complex of data. This is the proviso problem.

The rest of this chapter will do the following. I will outline the satisfaction theory's solution to the projection problem. I will then argue that the theory's commitment to presuppositions as constraints on the common ground is correct. This will entail that we must admit accommodation as a first class theoretical entity. This will motivate the search for a theory of accommodation. Most of the existing literature on accommodation has viewed it as form of common sense reasoning. I will argue that this view cannot be maintained. I will propose instead that the language faculty comes equipped with a module specifically dedicated to certain kinds of linguistic inference, including a system responsible for accommodation. I will provide a grammar for this module, one that can be used by any theory of presupposition that makes a sharp distinction between presupposition projection and presupposition accommodation (eg. Karttunen and Peters [74], Schlenker [107, 109], Fox [33], George [42]). The proviso problem will be solved in the process.

## 4.1 Presupposition Projection

Recall from Chapter 2 that the satisfaction theory proposes a semantic system that assigns CCPs to logical forms. Within this framework, an atomic LF can sometimes be assigned a *partial* function as its meaning, accepting only a limited subset of contexts as input. This was encoded in Definition 3 from Chapter 2:  $c + \phi$  is defined iff  $c$  entails  $\phi$ 's presupposition. This definedness condition extends to complex sentences in a straightforward way. Execution of  $c + \phi$  (where  $\phi$  is arbitrarily complex) will in general involve several operations of the form:  $c' + \psi_i$ ,  $\psi_i$  a constituent of  $\phi$ , and  $c'$  the local context of  $\psi_i$  (cf. Definition 2, Chapter 2). The function  $+ \phi$  will be defined on  $c$ , then, iff each operation of the form  $c' + \psi_i$  is defined. This is the key idea of the dynamic framework's approach to presupposition, the requirement of 'local satisfaction' (cf. Definition 4, Chapter 2).<sup>1</sup> It will be important to keep in mind that

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<sup>1</sup>The terminology begins with Karttunen [72].

this is, in its essence, all that the theory itself has anything to say (at this point) about presupposition. The LF of a sentence is assigned a CCP, whose execution is constrained by the requirement of local satisfaction.

We mentioned earlier that the empirical problem that has occupied most of the mental effort of linguists has been the projection problem: How do we predict the presuppositions of a complex sentence based on the presuppositions of its parts? Within the dynamic framework assumed here, there is no projection component in the grammar. The only way to provide an answer to this question is through the requirement of local satisfaction. Let us turn to some examples to illustrate. Consider the following three sentences:

1. The king of France is bald
2. The king of France is not bald
3. If there is a king of France, then the king of France is bald

Sentence (1) presupposes  $p$  = that there is a (unique) king of France. This means that a condition on the use of (1) in context  $c$  is that  $c$  must entail  $p$ . When we embed (1) under negation, as in (2), the complex sentence seems to inherit the presupposition that  $p$ , i.e. the use of (2) requires that it already be common ground that there is a king of France. When (1) becomes the consequent of a conditional, as in (3), we see that the complex sentence does not inherit the presupposition that  $p$ , i.e. it need not (in fact, cannot) be common ground that there is a king of France. I am using the term ‘presuppose’ in a theoretically loaded way, in that I am taking it to literally mean that, in an ideal conversation, such information should already be taken to be common ground by the conversational participants. It is not obvious that this is true. In fact, given the phenomenon of presupposition accommodation (to be discussed below), it seems rather dogmatic to insist on such an interpretation (as has often been argued). Observationally, all we have access to are various inference patterns. For instance, the use of (1) and (2) seem to imply  $p$ , whereas the use of (3) does not (it in fact implies that the speaker is ignorant about  $p$ ). In light of this fact, various theories of

presupposition (eg. Gazdar [41], Karttunen and Peters [74], van der Sandt [103]) have taken an inferential view of presupposition, not tied to the ‘pre’ in ‘presupposition.’ I should thus say something about why I insist on the foundational interpretation of presuppositions as constraints on the common ground.

One argument in favour of the common ground theory of presupposition comes from the *Hey Wait a Minute!* Test (HWAMT), due to Benny Shanon [111] and Kai von Stechow [24]. The diagnostic is offered as a way of teasing apart presupposed information from asserted content. Constraints of presupposition satisfaction dictate that a sentence  $\phi$  that presupposes  $p$ , henceforth represented as  $\phi_p$ , can be used in context  $c$  only if  $c$  already entails  $p$ . This means that when this condition is not met, the hearer has a choice: either accommodate the required information, or object to the speaker’s having violated the constraint. This in turn means that the hearer is always well within her rights to object to such a conversational move. This right does not extend to asserted content, since the whole point of an assertion is to update the context. The *HWAMT* is meant to capture exactly this:

***Hey Wait a Minute!* Test** In response to sentence  $\phi_p$  in context  $c$ , where  $c$  does not entail  $p$ , the hearer may object *Hey wait a Minute! I didn’t know that  $p$ !*, but she may not object *Hey wait a minute! I didn’t know that  $\phi$ !*

Please return your attention now to (1)-(3), which we repeat below. We see that the HWAMT indeed seems to target only the presupposed information:

1. S: The king of France is bald.  
H: Hey wait a minute! I didn’t know France has a king!  
H: # Hey wait a minute! I didn’t know the king of France is bald!
2. S: The king of France isn’t bald.  
H: Hey wait a minute! I didn’t know France has a king!  
H: # Hey wait a minute! I didn’t know the king of France isn’t bald!
3. S: If there is a king of France, then the king of France is bald  
H: # Hey wait a minute! I didn’t know that if France has a king, then the king

of France is bald!

Assuming now that the use of (1) in context  $c$  requires that  $c$  entail  $p$ , based on the results of the HWAMT, we can conclude that the use of (2) also imposes this requirement, while the use of (3) does not. As such, we will say that (1) presupposes  $p$ , as does (2) (negation ‘inherits’ the presuppositions of its argument), while (3) does not (a conditional does not necessarily inherit the presuppositions of its consequent). Facts such as these were first laid out in detail by Karttunen [71]. It turns out that these data points fall out as theorems of the entries proposed by Heim [55].<sup>2</sup> To see why, we should first write down the lexical entries for operators like  $\neg$  and  $\rightarrow$ . Here are some of Heim’s entries:<sup>3</sup>

**Lexical Entry for *not***  $c + \neg\phi_p = c - (c + \phi_p)$

**Lexical Entry for *if***  $c + (\psi \rightarrow \phi_p) = c - ((c + \psi) - (c + \psi + \phi_p))$

Consider the case of negation, first. What is the local context of  $\phi_p$ ? Given the CCP of  $\neg\phi_p$ , it turns out that we have:<sup>4</sup>

- $\mathcal{L}(\phi_p, \neg\phi_p, c) = c$

Then, by Local Satisfaction, we require that the local context of  $\phi_p$  satisfy its presupposition. Here the local context is just the global context  $c$ . Hence, the CCP framework predicts that negation should be a ‘hole’ for presupposition (Karttunen [71]), in that  $\neg\phi_p$  inherits the presuppositions of  $\phi_p$ .

For the case of conditionals, we can likewise associate the antecedent and the consequent with their local contexts:

- $\mathcal{L}(\psi, \psi \rightarrow \phi, c) = c$

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<sup>2</sup>This does not mean that they fall out as theorems of the CCP framework, given the stipulative character of the entries.

<sup>3</sup>Heim assumes a material implication analysis of conditionals, but there is of course nothing that forces this upon us. Any analysis could be implemented in the dynamic framework. For a dynamic implementation of the Stalnaker/Lewis theory of conditionals (eg. Stalnaker [124, 126], Lewis [85]), for example, see Heim [58].

<sup>4</sup>cf. Definition 2 on p.22 for our notational conventions here.

- $\mathcal{L}(\phi, \psi \rightarrow \phi, c) = c + \psi$

The local context of the antecedent is the global context itself,  $c$ . The local context of the consequent is  $c + \psi$ , the global context as incremented by the information contained in the antecedent. The constraint of Local Satisfaction then tells us that the conditional will be ‘admitted’ by  $c$  if and only if  $c$  admits the antecedent, and  $c + \psi$  admits the consequent. This means that a context  $c$  will admit (3) only if that context, when updated by the information in the antecedent (that France has a king), will entail that France has a king. But all contexts meet this condition, so that (3) does not denote a partial function at all. This gives rise to our intuition that (3) is presuppositionless, and does justice to the fact that no *HWAMT* is possible in response to (3). More generally, given the lexical entries assumed here one can always determine what a sentence presupposes using the constraint of local satisfaction.

## 4.2 Conditional Presuppositions

Keeping our attention on conditionals, for the moment, sentences such as those in (3) have been used since Karttunen [71] to argue for the following ‘projection’ behaviour: Sentences  $\psi \rightarrow \phi_p$  presuppose  $\psi \rightarrow p$ .<sup>5</sup> However, what are we to make of sentences like the following?

4. If John flies to Toronto, his sister will pick him up from the airport

The CCP framework predicts this sentence to presuppose that if John flies to Toronto, he has a sister.<sup>6</sup> This seems a rather strange prediction. What (4) really seems to presuppose is something stronger, namely, that John has a sister (whether or not he flies to Toronto). Indeed, the *HWAMT* seems to be happy with the stronger proposition here as well:

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<sup>5</sup>In addition, the conditional inherits the presuppositions of its antecedent. This follows from the lexical entry for *if* given above, as one can verify by examining this CCP together with the constraint of local satisfaction.

<sup>6</sup>This prediction is also made by non-dynamic systems, such as those of Karttunen and Peters [74], Schlenker [107, 109], Fox [33] and George [42]. I will focus my attention on the CCP framework, but the difficulties for that system that I’m about to mention would also arise for these other theories.

5. S: If John flies to Toronto, his sister will pick him up from the airport

H: Hey wait a minute! I didn't know John has a sister!

What's going on here? We clearly don't want to predict that conditionals  $\psi \rightarrow \phi_p$  presuppose  $p$ , for then we would incorrectly predict that (3) presupposes that there is a king of France. By generating a weaker conditional presupposition to get (3) right, we seem to get (5) wrong. In discussing the presuppositions of conditionals, Karttunen [72] wrote (p.184): 'One would like to find a better way to express [the presuppositions of conditionals], but I'm not sure there is one. It really is a complicated question.' His testimony on presuppositional matters is as good as anyone's, and this assertion foreshadowed much of the controversy that was to come surrounding the presuppositions of conditional sentences in particular, and the predictions of the satisfaction theory more generally.

Gazdar [41] judged the conditional presupposition prediction to be 'zany' (eg. p.148), and went on to develop an alternative approach under which the presupposition that  $p$  is generated directly. This presupposition is then inherited by the entire conditional so long as  $p$  does not get cancelled by his cancellation mechanism. In Gazdar's system, a presupposition of a constituent will be inherited by a complex sentence unless doing so would result in an inconsistent context. One of the things that can cancel a presupposition is an implicature. A conditional sentence of the form 'if  $\psi$ , then  $\phi_p$ ' has as an implicature that the speaker is ignorant concerning the truth-value of  $\psi$ . Thus, if  $\psi$  and  $p$  are equivalent, as in (3), the ignorance inference would be inconsistent with the presupposition that the speaker believes that  $p$ . To avoid this unhappy conclusion, Gazdar proposes a general principle dictating that presuppositions give way to implicature under threat of inconsistency. With such a principle in place Gazdar manages to capture (3) without difficulty. Is he also forced, then, like the satisfaction theory, into difficulties with (5)? It turns out that he is fine with (5) as well. There is no implicature generated by the sentence that would result in inconsistency with the presupposition that John has a sister. Thus, he correctly predicts that (5) should presuppose that John has a sister. By invoking a very simple cancellation mechanism, Gazdar's system is able to capture the intuitive judgments

concerning both (3) and (5).

There are other cases, though, where it's not clear which prediction is the one we want. And there are other yet other cases where the satisfaction theory offers a clear advantage over Gazdar's alternative. Consider the following examples, adapted from Soames [119, 120] and Heim [56]:

6. If John paid his bill today, his payment should arrive by tomorrow

7. If John made a payment, the fact that he paid his bill on time makes me happy

The satisfaction theory predicts (6) to presuppose that if John paid his bill today, then he made a payment, i.e. it presupposes nothing. Gazdar, on the other hand, predicts (6) to presuppose that John made a payment (since the speaker's ignorance about whether John paid his bill today is consistent with her epistemic certainty that John made a payment). My intuitions are not so clear on the matter. On top of this, the application of the HWAMT can be read as felicitous, but the effect is rather ephemeral:<sup>7</sup>

8. S: If John paid his bill today, his payment should arrive by tomorrow

H: ? Hey wait a minute! I didn't know John made a payment!

For now, cases where the antecedent asymmetrically entails the presupposition of the consequent seem to not quite decide between the two.

Sentence (7) on the other hand seems to argue in favour of the satisfaction theory. First, note that it is distinctly odd. Heim [56] notes that the satisfaction theory has a ready explanation for this oddness. It predicts the sentence to presuppose that if John made a payment, then his payment was on time. But what kind of thing is that to presuppose in an out of the blue context? The oddness of the sentence would be related to the oddness of the presupposed proposition. Gazdar's system, on the other hand, has no account of the oddness of such a sentence. It predicts it to presuppose

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<sup>7</sup>There might be a concern with scope. But note that we get the same effect with non-scope taking presupposition triggers, eg. S: *If John used to smoke five packs a day, (I'm sure) he's stopped now.* H: Hey wait a minute! I didn't know John used to smoke! Information structure may also be relevant.

nothing at all (since the implicature that the speaker is not opinionated about whether or not John even paid his bill suffices to cancel the presupposition that John paid the bill on time), but this is not, in and of itself, enough to warrant oddness (especially not in this particular system, where it is a crucial feature that implicatures can cancel presuppositions). Moreover, as Heim [55] points out, Gazdar’s theory does not generalize in any obvious way to apply to sub-propositional constituents (eg. in order to deal with presupposition projection in quantified sentences). These difficulties for Gazdar’s system motivate the search for an alternative explanation of the contrast between (3) and (5) within a dynamic setting.

One prominent response has been to maintain the spirit, but not the letter, of the CCP framework. What I have in mind here is the DRT approach to presupposition, pioneered by van der Sandt [103], and developed most extensively in Geurts [44]. I will not, unfortunately, have occasion to discuss this important line of thought here. I would like to focus instead on getting clear on what exactly it is that the satisfaction theory is claimed to have difficulty with. The conditional presuppositions that seem, on the one hand, exactly right (for cases like (3)), and at the same time so wrong (for cases like (5)) seem to be pointing to some kind of tension. What is this tension? What is it teaching us? Karttunen sensed early on that there was something rather non-trivial lurking behind conditional presuppositions (cf. the quote a couple of pages up). I will follow Beaver [4] and von Stechow [25] and suggest that the dilemma is teaching us that we need to supplement the theory of presupposition projection with a notion of presupposition accommodation.<sup>8</sup>

### 4.3 Presupposition Accommodation

Recall from just above that we are interpreting ‘presupposition’ in a particular way: as information that must be entailed by the context in order for some speech act to

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<sup>8</sup>Heim [58] made the same point with respect to presupposition in attitude contexts. Thus, she follows Karttunen [72] in taking *John believes it stopped raining* to presuppose (as a matter of projection) that John believes it was raining, and to have the additional inference that it was in fact raining follow from accommodation. We return to presupposition projection and accommodation in attitude contexts in Chapter 5.

be felicitous. It is of course a well-known fact that this condition need not be met. For instance, in a context where you don't know whether I have a sister or not, I can very well say to you, without any sense of annoyance or infelicity, something like:

9. I'm sorry I'm late. I had to pick up my sister from the airport.

Sentence (9) presupposes I have a sister, and I've just used it, I think properly, even though this information is not common ground. Data like this have often been used to argue that the common ground theory of presupposition rests on shaky foundations (Burton-Roberts [13], Gauker [40], Soames [121], Abbott [1], Thomason et al.).<sup>9</sup> How sound are the arguments?

Examples such as (9) were in fact already known to the pioneers of the satisfaction theory (Karttunen [72], Stalnaker [125]). It will be good for us to spend a few moments discussing why these facts are not, in and of themselves, problematic for the framework. It will also be important for helping us clarify the nature of the difficulty posed by the conditional presuppositions discussed in the previous section, and for helping us turn to a solution to those difficulties.

Karttunen and Stalnaker's theory of conversational dynamics is an attempt to characterize the nature of ideal conversations. Assuming fully cooperative, rational agents who are involved in a game of information exchange, the use of a presuppositional sentence requires that its presuppositions be satisfied by the context  $c$ . Now what happens when this condition is not met? First, in some sense, the theory must admit that the conversation has deviated from the normative ideal, even if there is no conscious awareness of this. Second, the fate of the conversation now rests on the hearer. If the deviation is unproblematic, then the hearer can simply repair the context, altering it to create a new context,  $c'$ , a subset of  $c$  that actually satisfies the presupposition of the sentence. This is the process of accommodation.<sup>10</sup> For instance, in response to my sentence (9), here are some possible repairs that would do the trick:

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<sup>9</sup>See von Stechow [25] for a detailed discussion of some of these arguments, as well as a careful response to them all. Building on von Stechow [24], I will put forth an additional argument here in defense of the approach.

<sup>10</sup>Lewis [86] coined the term 'accommodation,' and was the first to present an extended analysis of the concept, though, as mentioned, Karttunen [72] and Stalnaker [125] had already discussed cases of presupposition accommodation.

10. (a)  $c \cap \{w : \text{Raj has a sister in } w\}$   
 (b)  $c \cap \{w : \text{Raj has a nice sister in } w\}$   
 (c)  $c \cap \{w : \text{Raj has a sister who owns a car in } w\}$   
 (d)  $c \cap \{w \in c : \text{Raj has a nice sister who owns a car in } w\}$   
 ...

Any one of these would suffice to create a new context that would satisfy (9)'s presupposition. Although (10a) is all that is strictly speaking required, in that it is the minimal repair needed to fix the context,<sup>11</sup> in principle it seems any of the other options (10a-10d) should also be available for accommodation, so long as it would make sense for speaker and hearer to agree to take such information for granted. Suppose, in this case, that the minimal repair makes the most sense. It has often been pointed out (eg. Karttunen and Peters [74], Heim [58], von Stechow [25], Abbott, etc.) that presupposed information should be uncontroversial. In our example, the proposition that I have a sister seems to be of no moment, which should facilitate accommodation, should the hearer choose to do so.

On the other hand, the hearer may not be so accommodating. As discussed earlier, no matter how uncontroversial or otherwise plausible the presupposition may be, the hearer is always within her conversational rights to object to having to accommodate this information. Kai von Stechow's HWAMT teaches us this fact. For instance, in the above, having just agreed that your accommodating the information that I have a sister is in general unproblematic, and in general gives rise to no conscious awareness of difficulty, the hearer can nonetheless object:

11. Hey wait a minute! I didn't know you have a sister!

Again, this kind of objection can apply to presupposed information, but not to asserted information:

12. # Hey wait a minute! I didn't know you had to pick your sister up from the airport!

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<sup>11</sup>By this I mean that the context created by the accommodation in (10a),  $c'$ , is the weakest proposition required in order to ensure that update can proceed. Any proposition  $p$  such that  $c \cap p = c'$  would constitute a 'minimal repair,' in this sense.

13. # Hey wait a minute! I didn't know you have a sister and had to pick her up from the airport!

The fact that the hearer is licensed to object in this way to presupposed information no matter how plausible or uncontroversial, and never to asserted information, seems to me to argue quite strongly in favour of the view that presuppositions are constraints on the common ground. Moreover, no other view that I am aware of seems to offer any alternative perspective that would make sense of the HWAMT. I will thus assume that the common ground theory of presupposition is correct, and that cases of 'informative presupposition' teach us that there is an additional process of accommodation that can sometimes take place, should the hearer be charitable enough.

Having convinced ourselves that we need a theory of presupposition interpreted as imposing constraints on the context, and that presupposition accommodation is something that we must accept as part of our theory of presupposition, let us now try to state our puzzle somewhat more precisely. We are presently concerned with contrasts like the following:

14. If John has a sister, his sister will pick him up from the airport
15. If John flies to Toronto, his sister will pick him up from the airport

To make sense of the fact that (14) is non-presuppositional (no HWAMT applies, for instance), the satisfaction theory follows Karttunen [71] in predicting that conditionals  $\psi \rightarrow \phi_p$  presuppose  $\psi \rightarrow p$ . This means that (14) presupposes that if John has a sister, then he has a sister, which is to say it presupposes nothing at all. This captures our intuition, and predicts the inapplicability of any relevant HWAMT. Given this prediction, the theory is led to predict that (15) presupposes that if John flies to Toronto, he has a sister. And this is just zany. Or is it?

Proponents of the satisfaction theory have argued that this fact is not necessarily problematic for the theory, once issues of accommodation are given their proper due (eg. Beaver [4, 6], von Stechow [25], Heim [60], van Rooij [97], Singh [116], Pérez

Carballo [94]). The basic idea is that the theory is right to predict that the semantic presupposition of (5) (as determined by grammar) is that if John flies to Toronto, he has a sister, but that what gets accommodated (what we might call the pragmatic presupposition of (5)) is that John has a sister (unconditionally).

Before discussing this idea in greater detail, however, we will need to find a better minimal pair than (3) and (5). Since (3) is non-presuppositional, the issue of accommodation simply doesn't arise. If the semantic presupposition is in fact the conditional one as predicted by the satisfaction theory, one would expect it to sometimes be selected for accommodation whenever the need for accommodation should arise. Here is an example from Geurts [43] that behaves this way:

16. If John is a scuba diver, he'll bring his wetsuit

The satisfaction theory predicts (16) to presuppose that if John is a scuba diver, he has a wetsuit. Unlike (15), this seems entirely correct. The response to this is to say that the semantic presupposition is indeed the predicted conditional one, but that what one actually accommodates in response to the threat of presupposition failure in the two cases is different. Here then is our new minimal pair:

17. If John is a scuba diver, he'll bring his wetsuit

**Semantic Presupposition:** If John is a scuba diver, he has a wetsuit

**Pragmatic Presupposition:** If John is a scuba diver, he has a wetsuit

18. If John flies to Toronto, his sister will pick him up from the airport

**Semantic Presupposition:** If John flies to Toronto, he has a sister

**Pragmatic Presupposition:** John has a sister

The puzzle is now squarely a puzzle for the theory of accommodation: Given that the semantic presupposition in each case is a conditional  $\psi \rightarrow p$ , why do we sometimes accommodate precisely the semantic presupposition, while at other times we accommodate something stronger? Note that the existence of accommodation behaviour as exemplified by (18) teaches us that the theory of accommodation cannot be the simplest one imaginable, viz. one where you make the minimal accommodation needed

to satisfy the presuppositions of the sentence.<sup>12</sup> This would have ensured a happy state of affairs where the semantic presupposition and the pragmatic presupposition always coincide. Unfortunately, the theory will have to be a bit more involved than that.

### 4.3.1 Accommodation as Holistic Inference

Beaver [4] and von Stechow [25] put forth the following idea: The satisfaction theory is entirely correct in predicting the semantic presuppositions it does, but what a hearer accommodates in conversation is governed by extragrammatical factors, such as what we believe about the world, including crucially beliefs about the speaker's beliefs, intentions, etc.<sup>13</sup> Thomason et al. [131] also propose a theory of interpretation where 'accommodation' is a by-product of abductive inference.<sup>14</sup> Beaver [4] and Beaver and Zeevat [9] propose that the hearer's task in accommodation is the following: Given that the speaker  $S$  has used a sentence presupposing  $p$  (as determined by rules of grammar), accommodate proposition  $q \subset p$ , where  $q$  constitutes your best guess as to what the speaker's assumptions are. von Stechow [25] proposes a related hypothesis concerning the hearer's task: Given that the speaker  $S$  has used a sentence presupposing  $p$  (as determined by rules of grammar), you must move to a new context  $c'$  which entails  $p$ . Move to that context constituting your best guess as to what the speaker's intended target common ground is.

Before trying to spell out this kind of reasoning in a more general fashion, let us state, informally, how this is meant to be applied to our minimal pair (17)/(18). Consider first (18), and assume that it is uttered in a context that doesn't satisfy its conditional presupposition (that if John flies to Toronto, he has a sister). It therefore

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<sup>12</sup>See Heim [58], Beaver and Zeevat [9], von Stechow [25] for discussion.

<sup>13</sup>Karttunen and Peters [74] make a similar move, developing a theory of presupposition where the projected proposition is indeed the weaker conditional, which can be strengthened via conversational reasoning. What I have to say in this section follows for their proposal as well, but since I am focussing on the dynamic system of Heim [55] here, I will not discuss their related proposal in detail. I hope the reader will trust that the issues here are general enough to be reformulated across theoretical frameworks.

<sup>14</sup>I have put 'accommodation' in scare-quotes because, for them, there is no such thing as accommodation, but only reasoning about the speaker's private commitments based on what she's said, mutual knowledge, etc.

also doesn't entail that John has a sister. Now, under von Fintel's formulation, the hearer compares the plausibility of the following: (i) The speaker wishes me to move to a context entailing that if John flies to Toronto, he has a sister *without* entailing that John has a sister, (ii) The speaker wishes me to move to a context entailing that John has a sister.<sup>15</sup> Now, it is a matter of common sense/abductive reasoning to determine which of these hypotheses is better. In this case, it turns out that (ii) is better, so the hearer can accommodate that John has a sister.

The reasoning transfers straightforwardly to example (17). The hearer asks herself which of the following is more plausible: (i) The speaker intends her to move to a common ground entailing that if John is a scuba diver he has a wetsuit without entailing that John has a wetsuit, (ii) The speaker intends her to move to a common ground entailing that John has a wetsuit. In this case, (i) ends up 'winning' the competition, and so we simply accommodate the conditional that if John is a scuba diver, he has a wetsuit, without accommodating that John has a wetsuit.

Quite generally then, the response to (17)/(18) seems to have a fairly general character, one with far-reaching consequences concerning the architecture of interpretation. The grammar associates some sentences with presuppositions. These put constraints on the common ground. When these constraints are not met, we can sometimes repair the context by adding some information to it. This is the process of accommodation. The grammar, however, is not responsible for what gets accommodated. Instead it needs to 'talk to' external systems of the mind<sup>16</sup> to find an answer to the question, what should be accommodated? At this point, various sub-systems of the mind responsible for abductive reasoning may conspire to help the hearer decide what to accommodate. Once these external systems find the optimal solution to this

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<sup>15</sup>Stated in terms of reasoning about the speaker's epistemic state, as in the Beaver/Zeevat/Thomason et al. formulation, this would translate into the following comparison. Which of the following is more plausible: (i) That the speaker believes that if John flies to Toronto he has a sister without believing that John has a sister, (ii) That the speaker believes that John has a sister. It is crucial for the reasoning to work that we NOT compare: (i') The speaker believes that if John flies to Toronto, he has a sister, (ii') The speaker believes that John has a sister. Since (ii') asymmetrically entails (i'), there is no natural plausibility metric I am aware of that would make it a more likely/plausible proposition to accommodate. See von Fintel [25], Heim [60], and Pérez Carballo [94] for discussion.

<sup>16</sup>External to the grammar, of course.

decision problem, they feed it back to the interpretive system and accommodation takes place.

Several questions immediately arise. First, what is the space of hypotheses considered? For instance, in the examples we discussed above, we considered only two (intended) target common grounds for plausibility. But given the architecture assumed, there is no necessity to this. For instance, in (18) we could also have considered an additional intended target common ground where John not only has a sister, but a sister who happens to be nice. And similarly for other propositions.

A second issue is, given some hypothesis space of target common grounds or accommodation possibilities, what is the optimality metric that is used to decide between target common grounds/propositions for accommodation? The Beaver/von Fintel/Zeevat response is that the metric is some sort of plausibility measure. What is the calculus behind this?

A third question, related to the first two, is: given some hypothesis space for accommodation, and given some optimality metric that compares hypotheses, what information is used in determining which hypothesis is optimal? To see what I have in mind here, consider again the above response to (17) and (18). It seems quite intuitive that an agent is more likely to believe that John has a wetsuit on the condition that he's a scuba diver than that he has a wetsuit unconditionally. On the other hand, it seems more plausible that an agent should believe about some individual John that he has a sister whether or not he flies to Toronto, rather than that he has a sister only on the condition that he flies to Toronto. Where do such judgments come from? Are we utilizing our own subjective beliefs, or common beliefs shared by speaker/hearer? Either way, do we use all the information available to us, or just a limited subset thereof?

At this point, all three questions have been left open. However, the entailed architecture suggests that the grammarian might not need to provide answers to them at all. It might suffice to leave this task to other cognitive psychologists. Recall that accommodation is the responsibility of external systems. As such, it will be a product of whatever happens to guide such systems. Since we currently know very

little about the functioning of external systems (or ‘central systems’ in Fodor’s [28] terminology) it does not make much sense for the linguist to lose much sleep over the problem. Given the above proof of concept, the satisfaction theory need not be too troubled by the contrast in (17)/(18). We know that there are many points where belief systems interface with grammar, and this will be yet another of them. As progress is made in the theory of external systems, we will be able to make more precise predictions concerning this interface.

Unfortunately, Bart Geurts [43] has taught us that we’re not done yet, that the above answer will not suffice. He asks us to consider the following:

19. Mary knows that if John flies to Toronto, he has a sister

Due to the factivity of *know*, the satisfaction theory predicts (19) to semantically presuppose that if John flies to Toronto, he has a sister.<sup>17</sup> This, the reader will recall, is exactly the same presupposition predicted for (18). Unlike (18), however, what gets accommodated is NOT the proposition that John has a sister, but rather the basic semantic presupposition itself. Now we’re really stuck. If external systems receive some proposition from the grammar as input (here, that if John flies to Toronto he has a sister), and return a best accommodation on the basis of this proposition, why are different answers given to (18) and (19)? Clearly, something has gone wrong.

### 4.3.2 The Solution, in a Nutshell

Let me now state the task at hand. We have the following trio of facts:

20. If John is a scuba diver, he’ll bring his wetsuit

**Semantic Presupposition:** If John is a scuba diver, he has a wetsuit

**Pragmatic Presupposition:** If John is a scuba diver, he has a wetsuit

21. If John flies to Toronto, his sister will pick him up from the airport

**Semantic Presupposition:** If John flies to Toronto, he has a sister

**Pragmatic Presupposition:** John has a sister

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<sup>17</sup>See Heim [58] for a derivation.

22. Mary knows that if John flies to Toronto, he has a sister

**Semantic Presupposition:** If John flies to Toronto, he has a sister

**Pragmatic Presupposition:** If John flies to Toronto, he has a sister

This is the well-known ‘proviso problem,’ discovered by Geurts [43, 44]. The satisfaction theory makes what seems like a good prediction concerning presupposition projection in (20), but that same prediction seems to be wildly off the mark in (21). The response to this difficulty is to sharpen the architecture of interpretation, to separate neatly issues of presupposition projection (grammar) from issues of presupposition accommodation (pragmatic reasoning). Moreover, since accommodation is a matter of central system reasoning, the linguist cannot be expected to say much about how it functions. But then (22) teaches us that this response will not do, for even if we black-box-out the theory of accommodation, whatever system is responsible for accommodation seems to give different answers to the same input presupposition. Something has got to change, somewhere.

Geurts’ response is to reject the entire framework. I think we need not be so defeatist. Instead, I believe the discovery of the proviso problem presents a good opportunity to clarify some of the choice points left open in Heim’s short WCCFL paper. In what follows, I will try to build on the Beaver/von Stechow/Zeevat line of work on accommodation, as well as related approaches found in Karttunen and Peters [74], Heim [60], Pérez Carballo [94] and van Rooij [97], to try to make sense of this difficult set of facts. The general idea is that various independent factors concerning conversational reasoning dictate the different inferences made in the different cases. The task is evidently to spell out what these factors are, and why they allow different accommodation possibilities across constructions even when the semantic presuppositions are identical. Before developing a formal account of the reasoning involved, let me state at a descriptive level what my proposed solution will be. Following Heim [60], Pérez Carballo [94] and van Rooij [97], I will begin by holding the implicatures of conditionals responsible for the difference between (21) and (22).<sup>18</sup> More specifically,

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<sup>18</sup>Beaver [6] holds the presuppositions of conditional sentences responsible for the difference. More on this below.

I will argue that the reason there is no strengthening of the conditional presupposition under *know* in (22) is that the sentence generates an ignorance inference that the *speaker* is ignorant about whether John has a sister or not.

To make the argument, I need to establish two claims. First, that embedding under *know* does generate ignorance inferences about the speaker. Second, that implicatures do cancel potential accommodations. For now, I will follow Heim [60] in disallowing a proposition to be accommodated if doing so would conflict with an implicature/ignorance inference of the sentence.<sup>19</sup> The interaction between implicature possibilities and accommodation possibilities will play an important role in the theory of inference I propose in the next chapter. For the time being, assuming with Heim [60] that accommodated propositions must be consistent with implicatures/ignorance inferences, it remains then to convince the reader that there are ignorance inferences (for the speaker) under *know*. Let me try to establish this fact here.

First, consider the contrast between the following:

23. If John has a sister, he slept with her best friend last night

24. # If I have a sister, I slept with her best friend last night

Since Gazdar [41] it has been known that conditionals ‘if  $\phi$ , then  $\psi$ ’ generate speaker ignorance inferences concerning the antecedent and the consequent:  $\diamond_S \phi$ ,  $\diamond_S \neg \phi$ ,  $\diamond_S \psi$ ,  $\diamond_S \neg \psi$ . Given this, the contrast between (23) and (24) has a ready explanation. Sentence (23) generates, for example, the ignorance inference that the speaker does not know whether or not John has a sister. There is nothing outlandish about such an ignorance inference. Sentence (24), on the other hand, generates the ignorance inference that the speaker does not know whether she has a sister or not. This ignorance inference clashes with the common knowledge that the speaker knows

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<sup>19</sup>Gazdar [41] had a principle that looks similar, but was rather different in kind, since it dealt not with presupposition accommodation, but with potential presuppositions. See also Geurts [44] (Section 2.3) for a very detailed discussion of the difficulties that arise when a speaker forces a hearer to accommodate a presupposition that contradicts an implicature that was generated by a prior sentence.

whether she has a sister.<sup>20</sup> Using this kind of oddness as a detector of ignorance inferences then, observe that (24) retains its oddness when embedded under *know*:

25. # Sushil knows that if I have a sister, I slept with her best friend last night

Danny Fox (p.c.) has pointed out to me that speaker ignorance is also generated in DE environments, places where implicatures are generally quite difficult to get:

26. # No one knows that if I have a sister, I slept with her best friend last night

Although ignorance inferences for Sushil about the embedded conditional's antecedent and consequent are fairly straightforward to derive, and not very surprising, it is quite surprising to find ignorance for the speaker as well in such environments. If inferences of speaker ignorance under *know* are a more general phenomenon, we might expect them to show up in other constructions. For instance, consider the case of disjunctions, where we get the ignorance inference that the speaker is ignorant about the truth of each disjunct (Gazdar [41], Sauerland [105]). Now suppose it's common ground that I broke the typewriter, and consider the following contrasts (Irene Heim, p.c.):

27. (a) Mary knows that I broke the typewriter

(b) Mary knows that one of us broke the typewriter

(c) # Mary knows that I broke the typewriter or you did

Although (b) and (c) are equivalent, because (c) is expressed as a disjunction, it comes along with ignorance inferences. These ignorance inferences contradict common knowledge, and, like with the conditionals above, generate oddness.

These facts teach us that ignorance inferences about the speaker's epistemic state are generated under *know*. With the further assumption (from Heim [60]) that an ignorance inference  $\diamond_{sp} \wedge \diamond_S \neg p$  suffices to block an accommodation of proposition

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<sup>20</sup>This kind of oddness would then be of a kind with various other instances of oddness whose source has been argued to be a conflict between implicatures and common knowledge (Heim [57], Fox and Hackl [35], Schlenker [106], Magri [88], Chierchia, Fox, and Spector [17], Singh [118]).

$p$ , then the proviso problem will be solved. What remains to do is show how such ignorance inferences can be generated.

Heim [60], Pérez Carballo [94], and van Rooij [97] have argued that structures  $\lceil K_\alpha(\phi \rightarrow p) \rceil$  generate the implicature that  $\alpha$ , the subject, is ignorant about  $p$ . This implicature then joins with various further default contextual assumptions to generate the additional inference that the speaker is ignorant about  $p$ . An initial concern with these assumptions is their lack of generality. For example, van Rooij's default assumptions are centered around conditional sentences.<sup>21</sup> Given Heim's [58] argument that the proviso problem shows up in attitude contexts as well, a limitation to conditionals is probably not desired. For example, sentence (28) below is predicted by the satisfaction theory to presuppose only that John believes it was raining (Karttunen [71, 72], Heim [58]). However, we take away from it not only that John believes it was raining, but also that it was, in fact, raining:

28. John believes it stopped raining

Heim argues that the additional inference to it actually having been raining arises through accommodation. If she is right, then we probably don't want to limit a response to the proviso problem to those that arise because of conditional presuppositions.<sup>22</sup>

But then how does the additional inference to it having been raining arise? Heim suggests that it has to do with reasoning about the beliefs of other agents. Since accommodated propositions should generally be uncontroversial and unsurprising, a natural explanation for why John believes it was raining is that it was in fact raining, and that he was in a position to find out. This is a good reason, then, to accommodate

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<sup>21</sup>These involve assumptions about the independence (in Lewis' [87] sense) of the antecedent and consequent, in addition to various default assumptions about the relation between the subject's epistemic state and the speaker's.

<sup>22</sup>Beaver [6] proposes that there is no strengthening of the conditional presupposition under *know*,  $\lceil K_\alpha(\phi \rightarrow p) \rceil$ , because conditionals (in any environment, I presume) presuppose that the antecedent  $\phi$  is relevant to the consequent  $p$ . Beaver argues that this relevance presupposition suffices to block accommodation of the consequent (on analogy with Geurts' [43] scuba diver-wetsuit cases, where the (positive) relevance of being a scuba diver to having a wetsuit helps block accommodation of having a wetsuit). Since this proposal does not help with attitude contexts in any obvious way, we probably need a more general statement.

that it was raining.

Pérez Carballo [94] suggests that something like this might also be going on in the case of conditionals under *know*. Suppose that a knowledge attribution makes the subject of the sentence salient. On top of this, he suggests that strengthening a conditional presupposition  $\phi \rightarrow p$  to the consequent  $p$  will take place only if the following (default) assumption can be taken to hold: that for every salient individual  $x$ , it is more plausible that  $x$  believes  $p$  than that  $x$  believes  $\phi \rightarrow p$  without believing  $p$ . Since the knowledge attribution presupposes that the subject knows that  $\phi \rightarrow p$ , and implicates that she doesn't know  $p$ , the subject is a counterexample to the required default assumption. With the required default assumption no longer available, the option of strengthening the presupposition is also lost.<sup>23</sup>

At this point, there are at least three *prima facie* difficulties with the proposal. First, as with Beaver [6] and van Rooij [97], Pérez Carballo [94] invokes assumptions that are limited to conditionals. This makes it difficult to say what happens when we're dealing with something other than conditional presuppositions, such as in attitude contexts (28). Here, though, we might try appealing to Heim's reasoning. There might be general principles of reasoning about other people's beliefs which, if made sufficiently precise, could turn all proviso cases into a subclass of interagent reasoning. However, Geurts [44] has shown that we can generate the same semantic presupposition as in (28) without accommodating that it was in fact raining:

29. Mary knows that John believes it was raining

This motivates the need for a more precise, predictive theory of the kind of reasoning involved in accommodation.

Finally, what is the role of the default assumptions? As defaults, one might expect there to be exceptions, and when there are, one might expect conditional presuppositions under *know* to at least sometimes be strengthened. This seems contrary to fact.

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<sup>23</sup>Heim [60] offers Pérez Carballo's suggestion as one way of using the subject-ignorance inference to block accommodation. A second proposal she makes invokes embedded implicatures. But the implicature looks incorrect to me (that the consequent is false).

As I mentioned earlier, I will follow the Heim/Pérez Carballo/van Rooij program in trying to hold implicatures/ignorance inferences of the structures responsible for the existence (or lack thereof) of strengthenings of conditional presuppositions. I will differ from these proposals in two important ways. First, I will generate speaker ignorance inferences directly, without using subject ignorance inferences as intermediate objects in the computation. Second, what will be seen to be crucial for my analysis is actually not the existence of ignorance inferences, per se, but rather the makeup of certain sets of propositions I will assume are resources for conversational reasoning. It is important to note that ignorance inferences under *know* are not obligatory. This is clearest when the only thing that's relevant is what the subject of the sentence does or does not know:

30. A: How much has Mary figured out about you?

B: Well, not much. But she does know that if I have a sister, I slept with her best friend last night.

I have to ensure then that accommodation is not directly dependent on the existence or lack of ignorance inferences. We will see that our proposal does not in any important way depend on the generation of ignorance inferences. Rather, the most important element of the analysis will be seen to be the nature of certain sets of propositions, namely, candidate sets for implicature, and candidate sets for accommodation. The blocking of accommodation possibilities by ignorance inferences/implicatures will be a special case of a more general phenomenon of sets of alternatives creating *symmetry problems* for each other.<sup>24</sup> Much as it has been argued in the domain of implicature that there have to be formally defined alternatives for implicature reasoning to work (eg. Fox [31], Katzir [77]), I will argue in the next section that presupposition accommodation is also made with respect to formal alternatives. Having argued for the need for formal alternatives, I will propose that if the use of sentence  $\phi$  in context  $c$  requires accommodation, the set of alternatives  $\mathcal{H}$  for (global) accommodation is:

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<sup>24</sup>The symmetry problem has been used as an argument that we need formal alternatives for implicature computation. I will discuss this in greater details in the next chapter.

**Formal Alternatives for Accommodation, Roughly**  $\mathcal{H} = \{p: p \text{ is the (semantic) presupposition of a scalar alternative to } \phi\}$

To tell such an account, therefore, I must fix certain assumptions about the scalar alternatives of a sentence. This will be easy: I will follow the theory of alternatives laid out in Katzir [77].

Finally, I will need to say how, given a set of alternatives  $\mathcal{H}$ , the system decides what to accommodate. As I mentioned above, we might expect (following Heim [60]) the implicature domain to influence what members of  $\mathcal{H}$  remain eligible for accommodation. In fact, my proposal will argue for something stronger: that sets of alternative implicatures and sets of alternative accommodations will have a bidirectional influence on one another. We will see that the proposal accounts for all of the data discussed above: matrix conditionals, conditionals under *know*, and attitude contexts. The system's bidirectionality will also be seen to be necessary in solving an independent problem in the theory of implicature that arises in the study of attitude contexts.

In the next chapter I will: (1) Go over the basic assumptions I need from the theory of implicature (scalar alternatives and reasoning with them), (2) Argue for the need for formal accommodation alternatives, (3) Develop a reasoning system that handles implicature, accommodation, and their interaction. Architecturally, the entire system works within the grammar. I will thus call it a system of grammatical inference. My goal is to formalize and mechanize this system. Let me turn to this task now.

## Chapter 5

# A System of Grammatical Inference

The goal of this chapter is to develop a general theory of grammatical inference. By this I will mean a theory of implicature, presupposition accommodation, and their interaction. I will begin by outlining the theory of implicature that will be my starting point. My discussion will be brief, hitting only those topics that will be crucial for the development of the system I have in mind. Many issues will be glossed over. The two essential elements of the theory I will need are: (i) That the grammar must make available a set of alternative objects for scalar reasoning (to deal with the ‘symmetry problem’), and (ii) That reasoning with this set of alternatives happens within the grammar, blind to contextual information. For this task, I will borrow most heavily from Fox [31] and Katzir [77]. I will use Katzir’s theory of alternatives, with Fox’s theory of reasoning.<sup>1</sup>

I will then turn to the theory of presupposition accommodation. I will limit my review of the literature on accommodation to only those works that have directly addressed the proviso problem (for that empirical issue is the motivating drive behind the development of my proposal). As discussed in the previous chapter, accommodation has generally been thought to follow from rational, common sense inference

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<sup>1</sup>It is perhaps somewhat misleading to call Fox’s theory of implicature a theory of reasoning, since it actually involves application of grammatical rules (function application). I hope no confusion will arise by my terminology.

(eg. Beaver [4], Beaver and Zeevat [9], von Stechow [25], Thomason et al. [131]).<sup>2</sup> I will argue for an alternative perspective, where accommodation must take place with respect to a grammatically defined set of alternative accommodation possibilities. This will require a theory of alternatives. Since the grammar already seems to make alternative objects available in one domain (implicatures), it would make sense for it to use the same objects for reasoning about accommodation as well. As mentioned at the end of the last chapter, that is indeed what I will propose: the alternatives for accommodation are the presuppositions of the scalar alternatives of the asserted sentence. Assuming this to be so, since implicature computation takes place within the grammar, we might also expect accommodation to be determined by the language faculty alone, without reference to contextual information. Moreover, since the system responsible for implicatures and the system responsible for accommodation use the same objects, and both operate algorithmically without accessing world knowledge, we might expect interactions between the two. I will propose something stronger: that accommodation and implicature are the output of a single system.

## 5.1 The Theory of Implicature

Theories of implicature beginning with Grice [48] offer a general way to make sense of the fact that a sentence like (1) typically ends up conveying (1a) in context, though its semantic meaning is the weaker proposition expressed in (1b):

1. John ate some of the cookies
  - (a) **Implicated Proposition:**  $\{w : \text{John ate some but not all of the cookies in } w\}$
  - (b) **Semantic Proposition:**  $\{w : \text{John ate some but not all of the cookies in } w \text{ or he ate all of the cookies in } w\}$

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<sup>2</sup>DRT approaches to accommodation (eg. van der Sandt [103], Geurts [44]) are importantly different, in this respect. I hope to discuss the relation between my proposal and the DRT approach in future work.

The inference from (1b) to (1a) has generally been taken to follow from a general theory of rational action. With communication construed as a species of rational action, it inherits properties of our characterization of rational activity. In formal models of rational action it is assumed that an agent selects some act out of a set of alternative actions available to her. What guides the selection of one candidate or other is the drive to maximize utility, to perform that act that brings about the best effect. Pragmatic theory qua theory of rational action thus needs to specify what the alternative actions are, and what the utility or goodness measure is supposed to be. One standard assumption about the ‘goodness’ measure is that it should be taken to be ‘logical strength:’ Proposition  $p$  is better than proposition  $q$  only if  $p \subset q$ .<sup>3</sup> What about the alternative actions?

In (1), for instance, Grice proposed that the alternative action relevant for reasoning here is that the speaker could have asserted the following proposition instead of (1):

2. John ate all of the cookies

This would have been a better move, since (2) asymmetrically entails (1). Since the speaker didn’t assert this, assuming the alternative is relevant, she must not believe it to be true. Under the additional assumption that she’s opinionated about the truth of (2), we conclude that she believes that (2) is false. Finally, if it is assumed that the speaker knows wherefrom she speaks, the hearer can conclude that John didn’t, in fact, eat all of the cookies.<sup>4</sup> The important point, for now, is that the reasoning makes reference to alternatives that can be measured for goodness.

### 5.1.1 The Symmetry Problem and Formal Alternatives

It didn’t take long to find a gap in this style of reasoning. This gap came in the discovery of what’s come to be called the ‘symmetry problem,’ first discussed by

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<sup>3</sup>Though see Hirschberg [62] for arguments that logical strength is not general enough to capture the full range of implicature-like inferences.

<sup>4</sup>For implementations and much important debate, see eg. Gazdar [41], Levinson [84], Groenendijk and Stokhof [50], Horn [63], Gamut [39], van Rooij and Schulz [98], Sauerland [105], Spector [123], Fox [31], Katzir [77].

Kroch [82] and stated in its most general form in MIT lecture notes of Kai von Stechow and Irene Heim dating from the late 90s. The basic idea is that the right implicatures cannot be generated without imposing formal restrictions on the space of alternatives used in reasoning. For instance, what would happen if (1) had (3) as an alternative instead of (2)?

### 3. John ate some but not all of the cookies

Sentence (3) expresses a ‘better’ proposition than (1) (by our measure of logical strength), and so, by running our reasoning on this alternative, a quick computation reveals that we would predict a sentence like *John ate some of the cookies* to end up conveying the proposition that John ate all of the cookies. This is obviously a bad prediction.

What would happen if both (2) and (3) were alternatives to (1)? The most that could be concluded from our reasoning would be that the speaker is ignorant about whether John ate all of the cookies.<sup>5</sup> But that is not what happens in the wild. Instead, we behave as though the *only* alternative to (1) is (2). Sentence (3) is simply not considered. Without any obvious rationale for this coming from the theory of action, the conclusion is that such restrictions must be dictated by grammar itself.

The dominant approach to avoiding symmetry originates with Horn [63], who uses what have since come to be called ‘Horn Scales’ or ‘Horn Sets’ to restrict the space of alternatives. Certain lexical items are stipulated to belong on scales:  $\langle \exists, \forall \rangle$ ,  $\langle \diamond, \square \rangle$ ,  $\langle \vee, \wedge \rangle$ , etc. Once these are given, a sentence containing a member of the scale can be converted to an alternative sentence by replacing the scalar item with its scalemate. Thus, *John ate some of the cookies* has an alternative *John ate all of the cookies*, the latter generated by replacing ‘some’ by ‘all.’ The space of alternatives is thus restricted by what is stipulated to belong on a Horn scale. With such scales in place, there is no way to generate the symmetric alternative *John ate some but not all of the cookies*, and the symmetry problem is thus avoided.

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<sup>5</sup>See Fox [31] and Katzir [77] for detailed discussion.

Where do Horn scales come from? Gazdar [41] asserted that they're just 'given to us' (p.58). Roni Katzir [77] has argued that we can do better than that. He has provided a very general procedure for generating alternatives that actually does away with the notion of scale. Katzir's goal is to provide content to the notion 'structural alternative of a sentence.' By taking seriously the idea that alternatives in reasoning are generally no more complex than the asserted sentence itself, Katzir proposes the following definition of structural alternative:

**Structural Alternatives** Let  $\phi$  be a parse tree. Then parse tree  $\psi$  is a structural alternative to  $\phi$  if  $\phi$  can be transformed into  $\psi$  via a finite sequence of the following operations: (i) Deletion (removing edges and nodes from the tree), (ii) Contraction (removing an edge and identifying its edge nodes), (iii) Substitution of structures for other structures from a substitution source.

**Notation** Let  $A(\phi) = \{\psi: \psi \text{ a structural alternative to } \phi\}$ .

The first two operations (deletion and contraction) are strictly simplifying. They only allow you to generate to simpler structures ('graph minors'). The third is not necessarily simplifying. For instance, if we replace terminal elements with other terminal elements of the same category, we get the effect of Horn-scale type replacements. As stated, the definition leaves open the question of what the substitution source is. It should include at least the lexicon (to allow Horn-scale type replacements). Katzir provides arguments (which we will not review here) that it should also be extended to include the set of  $\phi$ 's subtrees. Here is the definition:

**Substitution Source** The substitution source for parse-tree  $\phi$  is the union of the lexicon of the language with the set of all subtrees of  $\phi$ .

How does this deal with the symmetry problem? Given the parse tree for (1), we can substitute *all* for *some* to get *John ate all of the cookies* as an alternative. But there is no way to get to *John ate some but not all of the cookies* via the transformational operations (i)-(iii). Note that this also predicts Sauerland's [105] alternatives

for disjunction, where he argues that the set of alternatives for  $\lceil X \vee Y \rceil$  is not merely  $\{X \vee Y, X \wedge Y\}$ , but the richer  $\{X \vee Y, X \wedge Y, X, Y\}$ . Katzir also shows how structural complexity is a better predictor of implicatures than scalarity. I will not go over these arguments here. For our purposes, what is important to note is that the proposal allows for an intensional characterization of alternatives, while outperforming competing ideas with respect to empirical predictions. I will thus assume that the space of alternatives available is that generated by Katzir’s procedure.

### 5.1.2 Reasoning with Alternatives

Now that we have a space of alternatives available, we need a theory of how we reason with them. Fox [31] has presented various arguments suggesting that the pragmatic reasoning mentioned above will not suffice. I will not review these arguments here, and simply adopt Fox’s procedure without comment.<sup>6</sup> It is this perspective that I will adopt, and adapt, in my own formulation.

It might be best to work through a concrete example. Suppose that  $\phi = \lceil X \vee Y \rceil$  has just been asserted. Fox proposes that the sentence is ambiguous. It can either be parsed with an exhaustive operator, *exh*, or not. If not, there is no strengthening at all, and the sentence has only the inclusive-or reading. The parse with an *exh* is the one that receives the strengthened exclusive-or meaning. *exh* takes the proposition denoted by the prejacent, and the set of propositions denoted by the alternatives to the prejacent, and concludes various things about these alternatives. The space of alternatives I assume here is that generated by Katzir’s procedure,  $A(\phi) = \{X \vee Y, X \wedge Y, X, Y\}$ . Fox’s reasoning works with propositions, so we simply convert this set of sentences to a set of propositions  $ALT(\phi)$ , those propositions denoted by each sentence in  $A(\phi)$ . Where no threat of confusion arises, I will use the same notational devices to pick out sentences and the propositions they denote, so that  $ALT(\phi) = \{X \vee Y, X \wedge Y, X, Y\}$ . Implicatures are generated as follows. The exhaustive operator can be viewed as a procedure that tries to negate

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<sup>6</sup>Please see the literature for extensive discussion, especially Chierchia [16], Fox and Hackl [35], Fox [31, 34], Magri [88], Chierchia, Fox, and Spector [17].

as many of these alternatives as possible. However, it is constrained by having to maintain consistency with the asserted proposition.<sup>7</sup> It satisfies these constraints by trying to find as many ‘maximally consistent exclusions’ as possible, where a maximally consistent exclusion is a maximal set of propositions from  $ALT(\phi)$  that can be negated while maintaining consistency with the asserted content. In this particular case, there isn’t a unique maximal exclusion. Instead, there are two maximal exclusions: (i)  $\{X, X \wedge Y\}$ , and (ii)  $\{Y, X \wedge Y\}$ . When there is not a unique maximal exclusion, it seems it would be arbitrary to select one exclusion as opposed to the other. Fox’s exhaustive operator breaks the Gordian Knot by excluding only those propositions that happen to be in every maximally consistent exclusion, for such propositions would be the only non-arbitrary exclusions. Fox calls such propositions ‘innocently excludable.’ Here, the only innocently excludable proposition is  $X \wedge Y$ . The output of the compositional semantics of  $exh(ALT(\phi))(\phi)$  is:  $\phi \wedge \neg\psi_1 \wedge \dots \wedge \neg\psi_k$ , where  $\psi_1, \dots, \psi_k$  are the innocently excludable propositions. In our running example,  $exh(ALT(X \vee Y))(X \vee Y) = (X \vee Y) \wedge \neg(X \wedge Y)$ . This is the exclusive-or meaning. Now what of the remaining alternatives whose truth-value is not determined by the output of compositional semantics? These get fed into the domain of pragmatic, interactive reasoning, where the hearer concludes that the speaker is ignorant concerning the truth-value of these alternatives. In our example, the truth-values of  $X$  and  $Y$  have not been determined, and so the hearer concludes:  $\diamond_S X \wedge \diamond_S \neg X \wedge \diamond_S Y \wedge \diamond_S \neg Y$ .

The theory thus makes a clear demarcation between grammatical inference and pragmatic inference. The process of innocent exclusion takes place entirely within the grammar, working only on the basis of logical relations between alternatives. It makes no reference to the speaker’s beliefs, or other extra-grammatical information. Once the mechanism of innocent exclusion has done its thing, various pragmatic inferences can be made about the remaining alternatives. Another important feature of the theory, which will not necessarily be important for us at this point, is that exhaustification can occur in arbitrarily embedded positions. Since the relevant operations

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<sup>7</sup>See also Groenendijk and Stokhof [50], van Rooij and Schulz [98, 99], Sauerland [105], and Spector [123] for arguments that such a constraint is needed.

take place inside the grammar, this architecture can make sense of the fact that implicatures can occur in any embedded position, where it is not clear what speech act could be taking place.<sup>8</sup> Let me now briefly summarize the purely grammar-internal processes of reasoning within this framework (with some minor terminological adaptations that will be useful to me later on, but are of no theoretical consequence):

- Given an LF  $\phi$ , construct a set of alternative LFs  $A(\phi)$  using Katzir’s procedure
- Take the propositions denoted by these alternatives:  $ALT(\phi) = \{p : p = [[\psi]], \psi \in A(\phi)\}$
- Negate each member of  $ALT(\phi)$ , generating the set:  $\mathcal{N} = \{\neg p : p \in ALT(\phi)\}$
- Find all the maximal subsets of  $\mathcal{N}$  that retain consistency with the prejacent. Call these maximally consistent subsets ‘Maximally Consistent Inclusions’
- If  $M_1, M_2, \dots, M_k$  are the Maximally Consistent Inclusions, take their intersection to generate the set  $M = M_1 \cap M_2 \cap \dots \cap M_k$
- $M$  is the set of innocently includable propositions<sup>9</sup>
- For each  $r \in M$ , conclude  $r$

## 5.2 The Theory of Accommodation

We were already introduced to accommodation in Chapter 4. We saw there that, to make sense of the HWAMT, the theory of presupposition needs to be interpreted as a common ground theory, one that incorporates a notion of accommodation. This notion of accommodation was appealed to in response to the proviso problem, but we saw that it runs into difficulties when conditionals are embedded under *know*. Following Heim [60], and more indirectly Pérez Carballo [94] and van Rooij

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<sup>8</sup>See the discussion in Chapter 3, as well as the extensive discussion in Chierchia, Fox, and Spector [17].

<sup>9</sup>Proposition  $r$  is innocently includable iff  $\neg r$  is innocently excludable. I will use the terms interchangeably, dictated only by convenience.

[97], I suggested that the solution lies in the interaction between implicatures and accommodation. We will ultimately see that we can provide a more general statement that will derive the Geurts/Heim principle as a special case. But let me begin by adopting this principle, to see how far it can take us. To have a predictive theory of the interaction between implicatures and accommodation, we need a theory of accommodation that is as explicit as the theory of implicature. The goal of this chapter is to bring us to the point where this is so. It is worth stressing that, although I have been working with the satisfaction theory, everything I say here should be applicable to any theory of presupposition that properly delineates the theory of projection from the theory of accommodation (eg. Karttunen and Peters [74], Beaver [4], Schlenker [107, 109], Fox [33], George [42]).

Let me begin, then, by trying to state the accommodation problem a bit more abstractly. Let  $G$  be a ‘goodness’ measure over propositions.<sup>10</sup> More specifically, if  $h, k$  are propositions, we use  $G(h|k)$  to assign proposition  $h$  a goodness score relative to background information  $k$ . Accommodation can then be stated as the following decision problem:

**Accommodation as a Decision Problem** Under the threat of presupposition failure, (i) Generate a set of hypotheses  $\mathcal{H} = \{h_1, \dots, h_k\}$ , where  $h_i$  is a candidate proposition for accommodation, and (ii) Accommodate  $\mathit{argmax}_h G(h|k)$ ,  $h \in \mathcal{H}$ .

In words, under threat of presupposition failure, you generate a set of candidate propositions  $\mathcal{H}$  for accommodation, from which one will be selected for accommodation, the one with the maximal ‘goodness’ score. A theory of accommodation should take as its task the specification of  $\mathcal{H}$ ,  $G$ , and  $k$ . That is what I will set out to do here. I will begin by trying to frame the accommodation theories of Beaver [4], Beaver and Zeevat [5], von Stechow [25], and Heim [60] in terms of  $G$ ,  $\mathcal{H}$ , and  $k$ , with the hope that it sharpens what exactly the choice points are. We will see that Heim’s proposal differs slightly from the others, so I will discuss her proposal separately. Let me begin

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<sup>10</sup>Different proposals have assigned different measures to  $G$ . Some of the more prominent ones have been plausibility (eg. Beaver [4], von Stechow [25]), computational cost (eg. Thomason et al. [131]), logical strength (eg. Blutner [11]), syntactic position in a DRS (eg. van der Sandt [103]).

with the Beaver/von Fintel/Zeevat approach to accommodation.

Recall from Section 4.3.1 that these theories take accommodation to be a form of inference to the best explanation. As such, accommodation belongs to ‘central system’ reasoning, that system or set of systems of responsible for rational thought and action. It follows, given what we know about central systems, that there are no formal constraints on the hypothesis space  $\mathcal{H}$ , nor on the background information  $k$  that’s used in deciding which of the hypotheses is judged best. Of course, in the normal course of events, it certainly doesn’t seem as though we consider all possible hypotheses, conditioned on all the information available. Since at least the work of McCarthy and Hayes [90], Newell and Simon [92], and other pioneers in AI/computational psychology research, we know that agents limit the amount of information they use in making decisions, solving problems, etc.<sup>11</sup> Such restrictions come from whatever it is that constrains rational thought and action generally, including perhaps memory limitations, employment of heuristics instead of algorithms, salience measures, etc. However, in principle, no piece of centrally represented information is off limits, so long as it can be established to be relevant, etc. “Crudely: everything the scientist knows is, in principle, relevant to determining what else he ought to believe. In principle, our botany constrains our astronomy, if only we could think of ways of making them connect.” (Fodor [28], p.105) By assimilating accommodation with central system reasoning, the Beaver/von Fintel/Zeevat proposal imposes no formal constraints on the values  $h$  can take,<sup>12</sup> nor on the values  $k$  can take. As such, we need say nothing about those at this point. Concerning the goodness measure  $G$ , I read the Beaver/von Fintel/Zeevat line on accommodation as taking it to be a plausibility measure, though it remains to be worked out what the plausibility calculus should be. Thus, in terms of our notational devices, here is the shape of accommodation within such systems:

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<sup>11</sup>cf. The discussion of the ‘frame problem’ in Fodor [28, 29]. For related discussion on the relation between information accessibility and the problem of logical omniscience, see Stalnaker [127].

<sup>12</sup>Other than the general shape of the hypotheses: For von Fintel, what you are comparing are target common grounds, while for Beaver and Zeevat, what you are comparing are propositions concerning the speaker’s beliefs. But with this specification out of the way, there are no other constraints.

**Beaver/von Fintel/Zeevat on Accommodation**  $\mathcal{H}$  can be any set of the right kind (eg. target common grounds, propositions about the speaker’s epistemic/buletic state, etc),  $k$  can be any information accessible to central systems,  $G$  is a plausibility measure.

Heim [60] follows this line of reasoning in assuming no constraints on  $k$ , and in taking  $G$  to be a plausibility measure, but she is somewhat more explicit about the assumed makeup of the hypothesis space  $\mathcal{H}$  and its relation to the goodness score  $G$ . First, she takes  $\mathcal{H}$  to be a set of salient propositions, though she leaves the concept of salience unanalyzed. For instance, in (21) from Chapter 4 (*If John flies to Toronto, his sister will pick him up from the airport*), she assumes the following set of alternatives:  $\mathcal{H} = \{TO \rightarrow SIS, SIS\}$ .<sup>13</sup> She further suggests that  $G$ , the goodness measure over candidates, is sensitive to plausibility judgments. However, as discussed earlier, for  $SIS$  to get a higher  $G$  score than  $TO \rightarrow SIS$ ,  $G$  can’t be a plausibility measure directly over propositions in  $\mathcal{H}$ . To address this difficulty, Heim suggests the following line of reasoning, which is a different way of stating a similar move made by von Fintel [25] and Pérez Carballo [94]. First, take  $\mathcal{H}$  and transform it into a set  $\Box_S(\mathcal{H}) = \{\Box_S h : h \in \mathcal{H}\}$ . Here we read ‘ $\Box_S h$ ’ to mean ‘the speaker takes for granted that  $h$ .’ We are now in the domain of interactive reasoning. Second, in order to allow non-trivial plausibility comparisons, we break the entailment relation between the alternatives by exhaustification:<sup>14</sup>  $exh(\Box_S(\mathcal{H})) = \{\Box_S h \in \Box_S(\mathcal{H}) : \Box_S h \in \Box_S(\mathcal{H})\}$ . I hope it will help notationally if I use  $\mathcal{H}^*$  in place of  $exh(\Box_S(\mathcal{H}))$ . Now assume we have access to a plausibility measure  $P$  over the members of  $\mathcal{H}^*$ , sensitive to background information  $k$ . Then we derive our goodness score  $G$  over  $\mathcal{H}$  from the plausibility measure  $P$  over  $\mathcal{H}^*$ : for all  $h, h' \in \mathcal{H}$ ,  $G(h|k) > G(h'|k)$  iff  $P(exh(\mathcal{H}^*)(\Box_S h)) > P(exh(\mathcal{H}^*)(\Box_S h'))$ . In words, proposition  $h \in \mathcal{H}$  is a better candidate for accommodation than proposition  $h' \in \mathcal{H}$  iff the plausibility measure assigned to the proposition that the speaker believes only  $h$  (relative to background set  $\mathcal{H}^*$ ) is greater than the plausibility measure assigned to the proposition that

<sup>13</sup>Legend: ‘TO’ = John flies to Toronto, ‘SIS’ = John has a sister.

<sup>14</sup>Heim uses a slightly different lexical entry than the one presented in the previous section, but no harm will come if the reader uses the one we introduced above.

the speaker believes only  $h'$ . Accommodation will result by finding the maximal element in  $\mathcal{H}$  with respect to this ordering. Of course, if there is no maximal element, communication will be predicted to break down.

To see the predictions of the theory, let us return to example (21). Regarding the space of salient propositions, we have:  $\mathcal{H} = \{TO \rightarrow SIS, SIS\}$ . This first gets converted to:  $\Box_S(\mathcal{H}) = \{\Box_S(TO \rightarrow SIS), \Box_S SIS\}$ . We then exhaustify:  $\mathcal{H}^* = \{\Box_S(TO \rightarrow SIS) \wedge \neg\Box_S SIS, \Box_S SIS\}$ . We then compare the members of  $\mathcal{H}^*$  for plausibility and, in this case, we find that  $\Box_S SIS$  is more plausible (with respect to some background information  $k$ , left unspecified). Thus, we will accommodate  $SIS$ . Similar reasoning applies to (20), though in that case we end up accommodating  $SD \rightarrow WS$ <sup>15</sup> because  $\Box_S(SD \rightarrow WS) \wedge \neg\Box_S WS$  is more plausible than  $\Box_S WS$ . In addition to these cases, Heim also tries to address what happens in (22), where a conditional presupposition generated under *know* simply doesn't get strengthened. We will discuss this line of attack in greater detail a bit later in the chapter, once we've settled on some crucial features of accommodation. Before doing so, let us take stock. In terms of our notation, we can state Heim's proposal as follows:

**Heim on Accommodation**  $\mathcal{H}$  is a set of salient propositions (where the concept, 'salience,' is left unanalyzed),  $k$  can be any information accessible to central systems,  $G$  is a goodness measure derived from a plausibility measure  $P$  over propositions in  $\mathcal{H}^*$ .

Within our notation, we see that neither approach to accommodation imposes limits on  $k$ , and both approaches employ a plausibility metric for goodness  $G$ , though Heim takes a slightly more nuanced stance concerning  $G$  and its relation to  $\mathcal{H}$  ( $G$  supervenes on a plausibility measure over exhaustified alternatives). Regarding  $\mathcal{H}$ , the Heim system counts on salience to restrict the set of alternatives, while the Beaver/von Fintel/Zeevat system relies on central systems to restrict the space of possibilities considered. As discussed above, each system relies on external systems for answers to appropriate values for  $\mathcal{H}$ ,  $G$ , and  $k$ .

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<sup>15</sup>Legend: 'SD' = John is a scuba diver, 'WS' = John has a wetsuit.

In what follows, I would like to argue for a different perspective. I hope to show that the task of accommodation cannot be left to external systems. I would like to begin by arguing that the space of alternatives,  $\mathcal{H}$ , is determined by the grammar alone, blind to centrally stored information. Should the arguments turn out to be sound, they would save us from having to stipulate values for  $\mathcal{H}$  on a case by case basis. As I mentioned earlier, I will ultimately conclude that the alternatives for accommodation are derived from the alternatives for implicature. This would leave only  $k$  and  $G$  to be worked out by some future theory of central systems. With  $\mathcal{H}$  worked out, however, I hope to convince the reader that we can also say something substantive and predictive about  $k$  and  $G$ . More specifically, I will argue for a modular theory of presupposition accommodation, one that has no capacity to make reference to world knowledge. Instead, the proposed system will enrich universal grammar by adding an additional module, viz. an accommodation module, to its inventory. My goal is to argue for the existence of this module, and then to mechanize it, with  $\mathcal{H}, G, k$  determined by the language faculty alone.

### 5.2.1 The Need for Restricted Alternatives

The goal of this section is to present evidence in favour of the following claim: The hypothesis space of alternatives for accommodation is determined by the grammar, without access to common knowledge. There are at least two motivations for a theory of formal alternatives. First, if Heim [60] is right that we compare exhaustified propositions for plausibility, then we have to be specific about the alternatives involved. As discussed in Chapter 3, *exh*, like *only*, takes a set of alternatives as an argument, a set whose makeup is restricted by principles of grammar. In addition to this motivation, I will use the HWAMT, which we've already seen, to argue that the alternatives for accommodation *cannot* come from outside the linguistic system. The properties of the HWAMT turn out to be far more complex than I will present here. I will present an initial argument to motivate a theory of formal alternatives here, and will return, in Section 5.3.4, to some of the more complicated facts concerning the HWAMT. We will see there that the complications do not affect the conclusions we reach here in

this section.<sup>16</sup>

Let me turn now to the HWAMT. A hearer who makes the conversational move, *Hey wait a minute! I didn't know that p!*, is expressing her conversational right to object to being forced to accommodate proposition  $p$ . It is important to note in this regard that the HWAMT probes (under the assumptions we are making about presupposition projection) not only the semantic presupposition of the asserted sentence, but rather whatever it is that is supposed to be accommodated, as the following example shows:

4. S: If John flies to Toronto, his sister will pick him up from the airport.

H: Hey wait a minute! I didn't know John has a sister!

Moreover, assuming that there is a determinate output common ground  $c'$  that speaker and hearer are supposed to move to (so that the full effect of a context change is expressed as a function, not a relation), this will fix the set of propositions that can be accommodated (any proposition  $p$  such that  $c \cap p = c'$ ).

One potentially useful property of the HWAMT is that it seems to offer us a powerful diagnostic to counter the uncertainty of our intuitive judgments in locating the source or responsibility of any particular inference as being due to accommodation, or meaning, or implicature, or something else entirely. If we find some inference  $p$ , and we're unsure as to what kind of inference it is, we can stick it in a HWAMT. If the HWAM objection is felicitous, that might be evidence that  $p$  arose through accommodation. If the HWAM objection is infelicitous, then that might be evidence that  $p$  arose through some other mechanism.

Now consider the following scenario. Imagine we're in a context where it is common knowledge that John's family has a long history of breeding German Shepherds, and only German Shepherds. It is allowed for any particular family member to not have a dog, but if you do have a dog, it's got to be a German Shepherd. Thus let it be common knowledge (among all parties relevant to the conversation below) that

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<sup>16</sup>In fact, we will present further evidence in Section 5.3.5 in favour of the idea that alternatives are grammatically determined.

John has a dog iff he has a German Shepherd. Now Bill pays a surprise visit to John's place. John's cousin, Mary, answers the door:

5. Bill: Hi Mary, is John home?

Mary: Um, no. He's out walking his dog.

Bill: # Hey wait a minute! I didn't know John has a German Shepherd!

Bill: Hey wait a minute! I didn't know John has a dog!

Why is it OK for Bill to HWAM John's having a dog, but not his having a German Shepherd? If the accommodation system were allowed to access common knowledge, it would know that John's having a dog and his having a German Shepherd are contextually equivalent. Moreover, if accommodation is a matter of figuring out the best target common ground, the HWAMT should not differentiate between the dog/German Shepherd cases, since accommodating either (that John has a dog or that John has a German Shepherd) takes you to the same target common ground.

Here is another example with a similar flavour. Take the context to be the modern day United States, where (so far) all presidents have been white.

6. S: Since John was once president of the United States, his daughter must have gone to Yale or Harvard.

H: # Hey wait a minute! I didn't know John has white daughter!

H: Hey wait a minute! I didn't know John has a daughter!

Once you know John was once president of the United States, and that he has a daughter, you also know (given common knowledge) that his daughter is white. This information doesn't seem to help license a HWAM objection, though.

If we are right about the felicity conditions of HWAM objections, these facts might be teaching us that the space of propositions for accommodation are determined by grammar alone, without access to extragrammatical information. Of course, this still leaves open the question of whether the decision to accommodate some candidate or other is determined by grammar alone or whether external systems enter into that decision. That is a separate question, to be addressed in later sections of this chapter. For now, let me make the following interim conclusion:

**Restricted Alternatives** Suppose the assertion of sentence  $\phi$  in context  $c$  requires accommodation. The hypothesis space for accommodation  $\mathcal{H}$  is determined by principles of grammar alone, without access to information in  $c$ .

What does this mean, in practice? In the next section I will state various generalizations I had made in an earlier paper (Singh [116]) about the space of alternatives. I believe the generalizations are correct, though I believe my attempt at deriving them was unnecessarily restricted to the notational conventions of the CCP framework. I will try to overcome this limitation in the next section by using scalar alternatives to derive the required generalizations.

## 5.2.2 Deriving Hypothesis Spaces

Having motivated the need for restricted alternatives, we would like now to be able to derive the hypothesis space for accommodation for any given sentence. In generating the space of candidates, given the infelicitous HWAMTs from the previous section, we will restrict ourselves from accessing world knowledge. The only remaining accessible information is whatever we can squeeze out of the logical form of the sentence and the semantic system that interprets LFs. In Singh [116] I tried to use the descriptions of CCPs (hf. CCPDs) to generate hypothesis spaces of candidate propositions for accommodation. More specifically, I put forth a procedure which would take a CCPD as input, and return a hypothesis space for accommodation as output. My goal in formulating this procedure was to derive certain generalizations I had made concerning the sets of alternatives for various constructions. With such restricted alternatives in hand, one could simply plug them into any of the accommodation systems discussed above. Here are some of the generalizations I had come to:

**Hypothesis Space for Conditionals** The accommodation possibilities for sentences  $\ulcorner$  if  $\phi$ , then  $\psi_p \urcorner$  is:  $\{\phi \rightarrow p, p\}$

**Hypothesis Space for Knowledge Attributions** The accommodation possibilities for sentences  $\ulcorner K_\alpha(\phi) \urcorner$  is a singleton set:  $\{\phi\}$

**Hypothesis Space for Conjunctions** The accommodation possibilities for sentences

$\lceil \phi \wedge \psi_p \rceil$  is the same as for conditionals:  $\{\phi \rightarrow p, p\}$

Before discussing how such generalizations might come to be, let's briefly discuss how they can be used in a theory of accommodation.

First, the case of conditionals seems to correspond precisely to the space of accommodation possibilities we've seen so far in conditional sentences. For instance, the variation between (20) and (21) in Section 4.3.2 corresponds to this space of possibilities.<sup>17</sup>

My response to knowledge attributions like (22) (from Section 4.3.2) was simply to reject the possibility of strengthening in the first place. My procedure for converting CCPDs to hypothesis spaces for accommodation, when fed (the CCPD of) a sentence  $\lceil K_\alpha(\phi) \rceil$ , spit out a singleton set made up only of the complement of *know*. This, I argued, is the reason there is no strengthening under *know*; a strengthened alternative simply doesn't exist.

The case of conjunctions might warrant some discussion. The predicted semantic presupposition of such a conjunction is a conditional:  $\phi \rightarrow p$ . My procedure for generating hypothesis spaces, when fed the CCPD of such a conjunction, generated a two-membered set:  $\{\phi \rightarrow p, p\}$ . This, like the case of some conditionals, looks awfully suspect, for such conjunctions only give rise to the inference that *p*, and never to the weaker  $\phi \rightarrow p$ . Moreover, as pointed out by Geurts [43], it will not be obvious how to find evidence for the conditional presupposition in the first place. Even if we allow the grammar to generate such a presupposition, note that the assertion of a conjunction  $\phi \wedge \psi_p$  would end up entailing *p* anyhow, because: (i) It presupposes  $\phi \rightarrow p$  (by assumption), (ii) It asserts  $\phi$ , so (iii) by modus ponens, we infer *p*. So what is the evidence for the existence of a conditional presupposition in conjunctive environments? One response I gave in the paper was to simply embed these conjunctions under negation. As noted above (and the fact that negation is a hole for presuppositions), my procedure predicted that there should be two possible accommodations. Here are a

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<sup>17</sup>Beaver [4] has argued for the need to enrich the sets of accommodation possibilities to include lawlike statements. We will get back to these cases in Section 5.3.5.

couple of examples from the paper showing that both the conditional presupposition and its strengthened variant show up in such constructions:

7. It's not the case that (John works for Morgan Stanley and his limo is parked outside)

**Semantic Presupposition** If John works for Morgan Stanley, he has a limo

**Pragmatic Presupposition** If John is works for Morgan Stanley, he has a limo

8. It's not the case that (it's sunny in Cambridge and John's limo is parked outside)

**Semantic Presupposition** If John works for Morgan Stanley, he has a limo

**Pragmatic Presupposition** John has a limo

I believe the generalizations about the hypothesis spaces are correct. The question remains, of course, how we can come to these predictions in a general way. I had offered an algorithm, a function from CCP descriptions to hypothesis spaces, to get to these predictions. Since the only information used by the procedure was the CCPD of the asserted sentence, what was crucial in deriving the hypothesis space was not so much the semantic presupposition of the sentence, but its CCP description instead. This allowed me to predict variability in accommodation across constructions even when the constructions gave rise to the same semantic presupposition (as with conditionals and knowledge attributions). However, precisely because of its tight connection to the notational conventions of the CCP framework, there was a concern (as expressed at the end of the paper) about the generality of the approach. I would like to attempt a different approach here, one that I hope can be used by non-dynamic approaches to presupposition projection as well.

I will be helped tremendously by the results in the theory of scalar implicature discussed in Section 5.1. Why are such results important for us? They teach us, first, that independent of anything to do with presupposition, the grammar seems to make available sets of alternative objects that can be used for reasoning. Second, they give us a general procedure for how the grammar reasons with alternatives. Let me focus, for now, on the first point. Given that there is variation in accommodation

patterns (eg. conditional sentences sometimes generate conditional presuppositions, sometimes unconditional ones), and given that we seem to be restricted to grammatical resources in generating alternatives for accommodation (cf. our arguments from the HWAMT), it would be quite odd if the grammar used an entirely different mechanism for generating alternatives for accommodation. So let us pursue the simplest possible hypothesis concerning alternatives, given the developments in implicature, and see how far it takes us in deriving the generalizations I put forth above. First, a piece of notation: Let us use  $\pi(\psi)$  to pick out the presupposition of  $\psi$ . Here is what I propose:

**Hypothesis Spaces for Accommodation, Penultimate Version** Suppose  $\phi$  is asserted in context  $c$ . The hypothesis space for accommodation in  $c$  is:  $\mathcal{H} = \{\pi(\psi) : \psi \in A(\phi)\}$ .

In words, the hypothesis space for accommodation is a set containing the presuppositions of the scalar alternatives of the asserted sentence. Let's examine how this proposal fares with respect to our three generalizations stated above.

Let us begin with conditionals  $\lceil \text{if } \phi, \text{ then } \psi_p \rceil$ . First, since the asserted sentence  $S$  is always a member of its alternative set  $A(S)$ ,  $\mathcal{H}$  will include the semantic presupposition of this sentence:  $\pi(S) = \pi(\text{if } \phi, \text{ then } \psi_p) = \phi \rightarrow p$ . Now the only other constituent in this sentence containing a presupposition is the consequent. Using Katzir's deletion operations, we can get from  $\lceil \text{if } \phi, \text{ then } \psi_p \rceil$  to  $\psi_p$ . Thus,  $\psi_p \in A(\text{if } \phi, \text{ then } \psi_p)$ . Hence,  $\pi(\psi_p) = p \in \mathcal{H}$ . There are no other presuppositional items in the structure, so we have:  $\mathcal{H} = \{\phi \rightarrow p, p\}$ . This is precisely the generalization offered above.

The case of conjunctions  $\lceil \phi \wedge \psi_p \rceil$  works in exactly the same way. The semantic presupposition of the sentence,  $\phi \rightarrow p$ , is in  $\mathcal{H}$ . Moreover, the right conjunct  $\psi_p$  is in  $A(\phi \wedge \psi_p)$ , so  $\pi(\psi_p) = p$  is also in  $\mathcal{H}$ . Nothing else can be derived, so  $\mathcal{H} = \{\phi \rightarrow p, p\}$ . This, again, derives the generalization about conjunctions.

What about knowledge attributions? It looks like we're in trouble. Note that at least the following structural alternatives belong to  $A(K_\alpha(\text{if } \phi, \text{ then } p))$ : (i)  $K_\alpha\phi$ ,

(ii)  $K_\alpha p$ . Both are presuppositional, giving rise to factive presuppositions ( $\phi$  and  $p$ , respectively). Thus,  $\mathcal{H}$  will include at least the following as a subset:  $\{\phi \rightarrow p, \phi, p\}$ . This is not the generalization I offered above. Moreover, when conjoined with either of the Beaver/von Stechow/Fintel/Heim/Zeevat approaches to accommodation, we should at least sometimes find a sentence like *Agent  $\alpha$  knows that if  $\phi$ , then  $p$*  result in the hearer accommodating  $p$ . This never happens. It might be that, like with conditionals and conjunctions, there are very strong preferences to accommodate one or other of the members of  $\mathcal{H}$ , and that it takes a lot of tinkering to find the right context to get the alleged unattested accommodation. I've tinkered, and have been unable to find anything. Without evidence to the contrary, I will continue to insist on the correctness of the generalization about knowledge attributions I offered above, viz. that there is no alternative accommodation possibility. How do we reconcile this with our prediction that there exist formal alternatives different than the basic semantic presupposition itself?

All responses to the lack of strengthening under *know* (other than my own in Singh [116]) have argued that various pragmatic inferences conspire to ensure that the strengthened alternative,  $p$ , cannot be accommodated (Beaver [6], Heim [60], Pérez Carballo [94], van Rooij [97]). More specifically, the proposals attempt to use independently known properties of conditional sentences to derive the fact that strengthening is impossible in these environments. Following this line of thinking, it means that if we can isolate appropriate properties of the knowledge attribution sentences that ensure that no alternative other than the conditional can survive, then Geurts' proviso problem will be solved. At the end of Chapter 4 I provided evidence that such sentences generate ignorance inferences for the speaker. These inferences will have to be taken care of anyhow. If I can show that these inferences in fact follow from the framework of Section 5.1, then we will have isolated a good candidate for the required independent property. Moreover, if we make the following additional assumption (following Heim [60]), then the proviso problem will be no more:

**Heim's Principle: Implicatures and Ignorance Inferences Block Accommodation**

If  $\neg p$  is a scalar implicature, or if speaker ignorance inferences about  $p$  are gen-

erated,  $\diamond_{S\phi}$ ,  $\diamond_{S\neg\phi}$ , then if  $p \in \mathcal{H}$ ,  $p$  cannot be accommodated.

My task now is to show how the required ignorance inferences follow from the theory of Section 5.1. Let's begin by deriving, within the framework for implicature assumed here, a generalization about conditionals due to Gazdar [41]:

**Gazdar's Generalization About Conditionals** A conditional  $S = \ulcorner$  if  $\phi$ , then  $\psi \urcorner$  gives rise to the following ignorance inferences:  $\diamond_{S\phi}$ ,  $\diamond_{S\neg\phi}$ ,  $\diamond_{S\psi}$ ,  $\diamond_{S\neg\psi}$ .<sup>18</sup>

First, we use Katzir's [77] procedure to derive the set of alternatives to the conditional,  $A(S)$ . The obvious alternatives are: (i) the antecedent  $\phi$ , (ii) the consequent  $\psi$ . If these were the only members of  $A(S)$  different from  $S$ , then we would have  $\mathcal{N} = \{\neg(\phi \rightarrow \psi), \neg\phi, \neg\psi\}$ . Since both  $\neg\phi$  and  $\neg\psi$  are innocently includable<sup>19</sup> we would predict that a conditional  $S = \ulcorner$  if  $\phi$ , then  $\psi \urcorner$  should mean 'not  $\phi$  and not  $\psi$ '. This would be even zanier than the prediction of conditional presuppositions. It is a good thing, then, that we don't make this prediction, since these turn out to not be the only alternatives. Katzir's procedure allows one to replace 'if  $\phi$ ' with  $\neg$ ,<sup>20</sup> generating a new alternative: (iii)  $\neg\psi$ . Once we have this alternative, since the substitution source includes all subtrees of  $S$ , we can replace  $\psi$  in (iii) with the antecedent  $\phi$ , giving us the alternative: (iv)  $\neg\phi$ .<sup>21</sup> We thus have:  $A(S) = \{\ulcorner$  if  $\phi$  then  $\psi$ ,  $\phi$ ,  $\neg\phi$ ,  $\psi$ ,  $\neg\psi \urcorner$ . Thus  $\mathcal{N} = \{\neg(\phi \rightarrow \psi), \phi, \neg\phi, \psi, \neg\psi\}$ . Here, then, are the maximal inclusions: (i)  $\{\phi, \psi\}$ , (ii)  $\{\neg\phi, \neg\psi\}$ , (iii)  $\{\neg\phi, \psi\}$ . We cannot include  $\{\phi, \neg\psi\}$  because doing so would contradict the asserted proposition. Since the intersection of the maximal inclusions is empty, no member of  $\mathcal{N}$  is innocently includable. Hence, we predict the desired ignorance inferences for each constituent in  $S$ :  $\diamond_{S\phi}$ ,  $\diamond_{S\neg\phi}$ ,  $\diamond_{S\psi}$ ,  $\diamond_{S\neg\psi}$ .

Now let us see what happens when we embed such a conditional under *know*:

<sup>18</sup>'Clausal implicatures,' in Gazdar's terminology.

<sup>19</sup> $\phi \rightarrow \psi$  is consistent with  $\neg\phi \wedge \neg\psi$ .

<sup>20</sup>We assume that  $X$  can be substituted for sub-constituent  $Y$  only if  $X$  and  $Y$  have the same type. In the process of semantic composition, the sub-constituent 'if  $\phi$ ' takes an argument,  $\psi$ , and returns a truth value ( $\langle t, t \rangle$ ). Negation does the same ( $\langle t, t \rangle$ ). The substitution can thus be made.

<sup>21</sup>We also have: if  $\phi$ , then  $\phi$ , and similarly with  $\psi$ . But these will play no role in anything we say here, so I will speak as though they're not really alternatives.

9.  $S = \alpha$  knows that if  $\phi$ , then  $\psi$

The set of alternatives is  $A(S) = \{K_\alpha(\text{if } \phi, \text{ then } \psi), K_\alpha\phi, K_\alpha\neg\phi, K_\alpha\psi, K_\alpha\neg\psi, \text{ if } \phi \text{ then } \psi, \phi, \neg\phi, \psi, \neg\psi\}$ . Taking the propositions denoted by the members of this set, and negating them, yields:  $\mathcal{N} = \{\neg K_\alpha(\text{if } \phi, \text{ then } \psi), \neg K_\alpha\phi, \neg K_\alpha\neg\phi, \neg K_\alpha\psi, \neg K_\alpha\neg\psi, \neg(\text{if } \phi \text{ then } \psi), \phi, \neg\phi, \psi, \neg\psi\}$ . The maximal inclusions are: (i)  $\{\neg K_\alpha\phi, \neg K_\alpha\neg\phi, \neg K_\alpha\psi, \neg K_\alpha\neg\psi, \phi, \psi\}$ , (ii)  $\{\neg K_\alpha\phi, \neg K_\alpha\neg\phi, \neg K_\alpha\psi, \neg K_\alpha\neg\psi, \neg\phi, \neg\psi\}$ , (iii)  $\{\neg K_\alpha\phi, \neg K_\alpha\neg\phi, \neg K_\alpha\psi, \neg K_\alpha\neg\psi, \neg\phi, \psi\}$ . This means that the negations of the propositions denoted by the knowledge attributions are all innocently includable, while none of the constituents of the embedded conditional are. This means that the sentence is predicted to generate the following information: (i)  $\alpha$  knows that if  $\phi$  then  $\psi$  (assertion), (ii)  $\alpha$  is ignorant about both  $\phi$  and  $\psi$  (output of innocent inclusion), and (iii) so is the speaker (pragmatic ignorance inferences).<sup>22</sup> This sounds like a good prediction. In fact, (iii) is precisely what we laid out as our goal at the end of Chapter 4: We have derived ignorance inferences for the speaker when the conditional is embedded under *know*.

Getting back to presupposition accommodation, what do we predict? The semantic presupposition is, of course, the proposition denoted by the conditional complement, that if  $\phi$  then  $\psi$ . What is the hypothesis space of alternatives for accommodation? Recall our definition:  $\mathcal{H} = \{\pi(\psi) : \psi \in A(\phi)\}$ . This means that we will have all the factive presuppositions of the members of  $A(S)$  as alternatives for accommodation, and nothing else:  $\mathcal{H} = \{\text{if } \phi \text{ then } \psi, \phi, \neg\phi, \psi, \neg\psi\}$ . Out of this space of candidates for accommodation, only two would suffice to repair the context: (i) if  $\phi$ , then  $\psi$ , and (ii)  $\psi$ . Of these, of course, (i) is the only one ever accommodated. How do we get this fact? By appealing to the Geurts/Heim principle that ignorance inferences block accommodation. Given that we have  $\diamond_S\psi$  and  $\diamond_S\neg\psi$  as ignorance inferences, this effectively eliminates  $\psi$  as a candidate for accommodation. The only remaining candidate for accommodation is the conditional  $\phi \rightarrow \psi$ , exactly as required.

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<sup>22</sup>Recall that the alternatives whose truth-values are not determined by innocent inclusion are subject to ignorance inferences.

Now what happens when the only thing that's relevant is what  $\alpha$  does and does not know, cases where there seems to be no accompanying ignorance inference concerning the speaker (cf. Example (30) at the end of Chapter 4)? I cannot discuss this in full detail now, because I need to introduce two pieces of formal machinery. First, I need to state the interaction between relevance and formal alternatives. I will do this in Section 5.3.2, where I follow proposals of Fox and Katzir ([32], [36], [76]) concerning the interaction between formal alternatives and relevant alternatives. The basic idea is that relevance works to prune the set of formal alternatives. So, it will take the set of relevant propositions  $ALT(S) = A(S) = \{K_\alpha(\text{if } \phi, \text{ then } \psi), K_\alpha\phi, K_\alpha\neg\phi, K_\alpha\psi, K_\alpha\neg\psi, \text{if } \phi \text{ then } \psi, \phi, \neg\phi, \psi, \neg\psi\}$  and restrict it to only those propositions that are relevant. Since these will be (by assumption) only the knowledge attributions, the actual alternatives for reasoning (following Fox and Katzir) will be:  $ALT_R(S) = \{K_\alpha(\text{if } \phi, \text{ then } \psi), K_\alpha\phi, K_\alpha\neg\phi, K_\alpha\psi, K_\alpha\neg\psi\}$ . The negations of these propositions will be the implicatures. We will also have  $\mathcal{H} = \{\text{if } \phi \text{ then } \psi, \phi, \neg\phi, \psi, \neg\psi\}$ . In this case, no implicature or ignorance inference will block accommodation of any proposition from  $\mathcal{H}$ . And this is where the second missing piece of the puzzle will be needed. I haven't yet provided a theory of accommodation. I have so far only said what the alternatives for accommodation are. The case we worked through above was one in which only one of the candidates managed to survive Heim's Principle. But this is not the general case, and we will need to say what happens in such cases. I will discuss such cases in the next section (Section 5.2.3), and will return to Example (30) (from Chapter 4) in Section 5.3.2.

Let me briefly summarize where we are. I have put forth a proposal concerning the hypothesis space of candidates for accommodation: If  $\phi$  is uttered in context  $c$ , the alternatives for accommodation are  $\mathcal{H} = \{\pi(\psi) : \psi \in A(\phi)\}$ . This derives the generalizations about the hypothesis spaces for accommodation offered at the beginning of this section. We saw that the case of conjunctions and matrix conditionals was fairly straightforward. The case of embedding under *know* was slightly more involved. Here is what I needed to assume in order to take care of this case:

- The theory of implicature discussed in Section 5.1

- Heim’s Principle that implicatures/ignorance inferences can block accommodation possibilities

Our theory is still incomplete. The knowledge attribution discussed above left us with only one accommodation possibility. What happens when accommodation is not deterministic, i.e. when the grammar allows several accommodation possibilities? We have not yet coupled our theory of alternatives with a theory of reasoning with those alternatives. We have only specified  $\mathcal{H}$ . We still need to fill in values for  $k, G$ . We’ll begin the next section with a puzzle we introduced in Chapter 4, again due to Geurts [44], that will motivate an answer to this question. This puzzle will lead us to an apparently independent puzzle for the theory of scalar implicature. I believe these puzzles teach us that interactions between implicatures/ignorance inferences and accommodation do not end with the Geurts/Heim principle. More specifically, if we develop an inference mechanism under which accommodation candidates are allowed to cancel candidates for implicature, in effect allowing a bi-directional interaction between implicature and accommodation, both puzzles will be solved. And so it will be.

### 5.2.3 Reasoning With Alternatives

If the proviso problem is general enough, we should expect to find it outside the domain of conditional presuppositions as well. One case study that has received somewhat less attention is presupposition projection/accommodation out of attitude contexts. For instance, given that *it has stopped raining* presupposes that it was raining, what does the following sentence presuppose?

10. John believes it has stopped raining

We all infer upon hearing this sentence that it was raining. The attitude verb *believe* thus seems to behave like a ‘hole,’ in Karttunen’s [71] terminology. Given the possibility of proviso problems, however, we should be cautious about drawing such conclusions. Indeed, Karttunen [71, 72] and Heim [58] have provided evidence

against the thesis that *believe* is a hole. Instead, on the basis of examples like (11) below, they propose that *believe* is a filter, with (10) presupposing (as a matter of semantics) that John believes it was raining:

11. John mistakenly believes that it was raining, and he believes that it has stopped.

So why, then, do we spontaneously infer that it was in fact raining when we hear (10)? Actually, the problem is a bit more complicated, as Heim points out. We actually take away two pieces of information: (i) That it was raining, and (ii) That John believes that it was raining. Why? How? One would hope that a general theory of accommodation can provide an answer to this question.

Karttunen and Heim suggest that certain default assumptions about interagent beliefs are used to get (i) out of (ii). Heim tries to spell out this intuition along the following lines. The semantics tells us that John believes it was raining. A general feature of accommodation is that the accommodated proposition should be taken by the speaker to be uncontroversial and unsurprising (eg. Karttunen and Peters [74], Soames [121], Heim [58], von Stechow [25]). What does this assumption buy us in this context? Well, in normal contexts, a good guess as to why the speaker takes the proposition to be uncontroversial is that it was in fact raining, and John was in a position to find out. So long as these assumptions can be used in the reasoning, they give you good reason to infer that it is in fact raining.

The reasoning is coherent and elegant, but there are some reasons for caution. First, it is at least debatable that attribution of belief to an agent also imports a measure of justification for that belief (in contrast with knowledge). Second, and perhaps more importantly, our arguments for a modular component to accommodation should make us think twice before using information such as other agents' beliefs in accommodation. More worrisome, however, is the fact that we can find evidence that such information is in principle unavailable during accommodation. For instance, imagine a context where it is common knowledge (among speaker, hearer, and Mary) that John has a dog if and only if he has a German Shepherd. In such a context, from the proposition that Mary believes John has a dog (the semantic presupposition

of sentence (12)), a guess that John has a dog forces us into a guess that John has a German Shepherd. But only the former is accommodated:

12. S: Mary believes John is out walking his dog

H: Hey wait a minute! I didn't know John has a dog!

H: #Hey wait a minute! I didn't know John has a German Shepherd!

Bart Geurts [44] expresses a similar concern about this proposal.<sup>23</sup> Moreover, he uses his earlier trick of embedding under *know* to argue that the Karttunen/Heim reasoning will not work in general:

13. Mary knows that John believes it was raining

Sentence (13) semantically presupposes exactly what sentence (10) does, viz. that John believes it was raining. Geurts rightly points out that in this case, we do not accommodate that it was in fact raining. He proposes instead to analyze (10) as presupposing that it was raining (i.e. to treat 'believe' as a hole), and to explain the inference to 'John believes that it was raining' through an additional mechanism. He asserts that 'it is much harder, if not impossible, to come by an inferential schema that runs in the opposite direction' (p.138), i.e. from the proposition that John believes it was raining to both that he believes it was raining and that it was raining. I would like to suggest that impossible though it might be, the approach to the proviso problem offered above might give us a handle on such inferences. Given that (13) has a different representation than (10), we might expect an interaction with implicatures to shed some light on the inference patterns here. Let's see what we conclude about (10) by using implicatures, along with Heim's Principle that implicatures/ignorance inferences block accommodation, on our hypothesis space for accommodation.

First, we need to specify the space of alternatives to (10). These are:  $A(10) = \{B_j(S_r), S_r, K_j(S_r)\}$ .<sup>24</sup> Both of the alternatives different from the asserted sentence are innocently excludable, so we conclude:  $\neg S_r \wedge \neg K_j(S_r)$ . The hypothesis space for

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<sup>23</sup>See his Example (58) on p.165.

<sup>24</sup>Legend:  $r$  = that it was raining,  $S$  = it stopped raining,  $B_j\phi/K_j\phi$  = John believes/knows that  $\phi$ .

accommodation is:  $\mathcal{H} = \{B_j r, r, S_r \wedge K_j r\}$ .<sup>25</sup> Given Heim's Principle, the implicature  $\neg S_r$  suffices to block accommodation of  $S_r \wedge K_j r$ . We've got two possibilities remaining for accommodation:  $r, B_j r$ . Now what? We obviously can't select just one of them, since we infer both. So perhaps the algorithm tries to accommodate all the members of  $\mathcal{H}$  that it can consistently. Perhaps. But before deciding what to do with the members of  $\mathcal{H}$ , note that something has already gone wrong with our reasoning. First, we have the wrong implicature. Belief attributions don't implicate the falsity of the complement to *believe*:

14. A: Is there going to be an attack?

B: Mary did a lot of research into this, and she believes there will be.

So our implicature is wrong. If that is wrong, then it might not block the presupposition of the factive alternative from being accommodated. Let us try, then, to be clear on what the right implicatures of belief attributions are, and see what needs to be done to derive them. For example, what follows from the following sentence?

15. John believes it was raining

My judgment is that it means that John doesn't know that it was raining, and that the speaker takes it to be possible that it was raining, and she takes it to be possible that it wasn't raining. Are these correct? People's reported judgments seem to be not all that clear. I believe part of this is due to difficulties in determining what is relevant. One thing is clear: As (14) shows, so long as the complement sentence is relevant, we *do* get speaker ignorance inferences. An additional diagnostic for probing ignorance inferences comes in the form of our first-person oddness tests. Suppose we're in a context where John is showing Mary around his city. They've been walking around for many hours.

16. John: Do you want to stop for some pizza?

(a) Mary: Yeah, maybe. I'm hungry.

(b) Mary: Yeah, maybe. # Sue believes/thinks I'm hungry.

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<sup>25</sup> $\pi(B_j(S_r)) = B_j r, \pi(S_r) = r, \pi(K_j(S_r)) = r \wedge K_j r$ .

The second response is odd. I think it is odd because it generates an ignorance inference that Mary, the speaker, does not know whether or not she's hungry. Note that the oddness does not come from a more general condition against belief attributions serving as partial answers to questions:

17. John: Does Sue want to stop for pizza?

Mary: Yeah, maybe. I believe/think she's hungry.

Our goal, then, is to do the following. Given sentence  $B_j\phi$ , we have the following set of alternative sentences (ignoring  $B_j\phi$  itself):  $A(B_j\phi) = \{K_j\phi, \phi\}$ . From this set we get the following set of propositions denoted by each sentence in this set,  $ALT(B_j\phi) = \{K_j\phi, \phi\}$ .<sup>26</sup> We then negate these:  $\mathcal{N} = \{\neg K_j\phi, \neg\phi\}$ . In our current framework for implicature, both propositions are innocently includable. But we don't want this. We only want  $\neg K_j\phi$  to be includable, while we want ignorance inferences concerning  $\phi$ . We saw in Section 5.1 that we get ignorance inferences through symmetric alternatives.<sup>27</sup> I suggest that what creates the symmetry here is the set of alternative accommodation possibilities. Recall that  $\mathcal{H}$  is the set of presuppositions of the members of  $A(B_j\phi)$ . Since here there is only one presuppositional alternative,  $K_j\phi$ , we get that  $\mathcal{H} = \{\phi\}$ . If the input to innocent inclusion were  $\mathcal{H} \cup \mathcal{N}$ , then we would have the desired result. We would have:  $\mathcal{H} \cup \mathcal{N} = \{\phi, \neg K_j\phi, \neg\phi\}$ . The maximal inclusions would then be: (i)  $\{\phi, \neg K_j\phi\}$ , (ii)  $\{\neg K_j\phi, \neg\phi\}$ . The only innocently includable proposition is  $\neg K_j\phi$ . By considering the presuppositions of alternatives, we are able to create symmetry problems for implicatures that wouldn't otherwise arise. In other words, we've shown that Heim's Principle needs to be modified. The direction of influence between the implicature domain and the presupposition domain goes both ways. I will state the relevant principles more explicitly in just a moment, but before doing so, you might be wondering: why are we considering presuppositions at all, given that a sentence like (15) has no presuppositions in the first place? I

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<sup>26</sup>Recall our notational convention to use the same symbols to pick out sentences and the propositions they denote.

<sup>27</sup>It might be tempting to try to get symmetry by replacing 'John believes' by  $\neg$ , as we did with 'if  $\phi$ .' But this will not be possible, given that 'John believes' is never a constituent, and does not compose with the complement in function application.

think examples like the following show that we consider the presuppositional domain whenever any of the alternatives have a presupposition:

18. Mary only BELIEVES that it's raining

19. Only JOHN loves his wife

In (18) for example, with narrow focus on *believe*, the only alternative (following Rooth [100], Fox [32], Fox and Katzir [36, 76]) is that Mary knows that it's raining.<sup>28</sup> This has a presupposition that it is raining, and since there is no symmetric alternative (ensured by narrow focus), we would predict that (18) should mean that it is in fact raining, that Mary believes it, but doesn't know it (eg. she can't justify her belief).<sup>29</sup> In (19), we infer that all the alternatives to John (eg. Bill, Tom, Harry) are married, due to the existence of alternative sentences like *Bill loves his wife*.

Before showing how this idea predicts exactly the desired inferences in (10) and (13), let me state a bit more precisely the principle at work. Suppose  $\phi$  is the asserted sentence, and that  $A(\phi)$  is the set of Katzir Alternatives to  $\phi$ . This set of sentences automatically gives us two sets of propositions:  $\mathcal{N}$  and  $\mathcal{H}$ . So far, nothing is new. My only proposed innovation is to have innocent inclusion work not solely on  $\mathcal{N}$ , but on  $\mathcal{H} \cup \mathcal{N}$ . In this way, presuppositions and implicatures can create symmetry problems for each other. There is only one additional constraint to be added to the requirement that consistency be maintained with the assertion: If the asserted sentence itself has presupposition  $p$ , every maximal inclusion must itself also contain  $p$  as a member (to ensure there is no presupposition failure). The process of innocent inclusion then produces a set of propositions, the innocently includable ones. Those that emanated from  $\mathcal{N}$  will be the implicatures of the sentence. More specifically, the implicatures of the sentence will be the conjunction of all the innocently includable propositions from  $\mathcal{N}$ . The same reasoning applies, *mutatis mutandis*, for presuppositions: The accommodated proposition will be the conjunction of all the innocently

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<sup>28</sup>As mentioned earlier, I will discuss such restrictions on the formal space of alternatives in the next section.

<sup>29</sup>Out of  $\mathcal{N}$ , the only innocently includable proposition is that Mary doesn't know that it's raining. There is only one proposition in  $\mathcal{H}$ , namely, that it is raining, which comes from the alternative *Mary knows that it's raining*. This is also innocently includable.

includable propositions from  $\mathcal{H}$ . Finally, as before, whatever members of  $\mathcal{N}$  that are not innocently includable give rise to ignorance inferences.

Now how does this reasoning apply to (10)? Here are our computations:

- Asserted Sentence:  $\phi = B_j S_r$
- Alternative Sentences:  $A(\phi) = \{B_j S_r, K_j S_r, S_r\}$
- Candidate Propositions for Implicature:  $\mathcal{N} = \{\neg B_j S_r, \neg K_j S_r, \neg S_r\}$
- Candidate Propositions for Accommodation:  $\mathcal{H} = \{B_j r, S_r \wedge K_j r, r\}$
- Maximally Consistent Inclusions: (i)  $\{\neg K_j S_r, \neg S_r, B_j r, r\}$ , (ii)  $\{\neg K_j S_r, B_j r, S_r \wedge K_j r, r\}$
- Thus, the set of innocently includable propositions is:  $\{\neg K_j S_r, B_j r, r\}$
- Thus, the only implicature is:  $\neg K_j S_r$ , while the remaining candidate out of  $\mathcal{N}$ ,  $S_r$ , is given a (speaker) ignorance inference
- The accommodation is:  $r \wedge B_j r$

These are exactly the desired inferences.<sup>30</sup> It turns out that the machinery above also solves Geurts' concern in (13), which we repeat here as (20):

20. Mary knows John believes it was raining

Recall that Geurts' criticism was that, since (20) semantically presupposes the same proposition as (10), that John believes it was raining, why are the inferences different? In particular, why don't we also accommodate that it was raining in this case? Our answer is that there is no strengthening because, by the very nature of the alternatives, we're stuck in a symmetry problem. We don't need to run through any complicated computations to see why. It suffices to note that  $A(20)$  includes at least

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<sup>30</sup>This means that we have derived the otherwise puzzling fact that the presupposition seems to be interpreted both within the belief operator and outside it by using a general theory of implicature. This result obviates the need to appeal to a copying mechanism (Zeevat [134]) designed solely for such facts.

the following two sentences: (i) Mary knows that it was raining, (ii) It was raining. Because of this, the presupposition of (i), which is (the proposition denoted by) (ii) itself, will be a member of  $\mathcal{H}$ . Moreover, the negation of the proposition denoted by (ii) will be a member of  $\mathcal{N}$ . This creates a symmetry problem, in that (ii) will not be innocently includable. In fact, we predict that the speaker is ignorant about this proposition. Here is the outline of the full meaning predicted for this sentence:

- Assertion:  $\phi = K_m B_j r$
- Semantic Presupposition:  $B_j r$
- $A(\phi) = \{K_m B_j r, K_m r, B_j r, r, K_m K_j r, K_j r, B_m B_j r, B_m r, B_m K_j r\}$
- $ALT(\phi) = A(\phi)$  (by our notational sloppiness), and so  $\mathcal{N} = \{\neg K_m B_j r, \neg K_m r, \neg B_j r, \neg r, \neg K_m K_j r, \neg K_j r, \neg B_m B_j r, \neg B_m r, \neg B_m K_j r\}$
- $\mathcal{H} = \{r, K_j r, B_m r, B_j r\}$
- Given our constraints (consistency with assertion, and inclusion of semantic presuppositions), the only innocently includable propositions are: (i)  $B_j r$ , (ii)  $\neg K_m r$ , (iii)  $\neg B_m K_j r$ , (iv)  $\neg K_m K_j r$
- Since (iv) is entailed by (iii), our implicatures are (ii) and (iii)
- The only accommodation is the semantic presupposition itself, (i)
- The only members of  $ALT(\phi)$  whose truth value is not determined by innocent inclusion are: (i)  $K_j r$ , (ii)  $B_m r$ , (iii)  $r$ . About these, we conclude ignorance inferences for the speaker

I trust that the reader can verify that our inference system still handles the more popular versions of the proviso problem involving conditional presuppositions.

## 5.3 Grammatical Inference as Part of a Deductive System

We offered a system of grammatical inference above that operates entirely within the grammar, without access to information that might be taken to be centrally stored. In fact, the inference system seems to access *only* that information that might be called ‘logical,’ making use only of the logical vocabulary along with logical notions such as consistency. Thus it would seem that the relevant computations are performed within Fox’s [30] Deductive System, DS.<sup>31</sup> In terms of filling out our general format for accommodation (Section 5.2), here is how we would specify the relevant parameters: (i)  $\mathcal{H}$  is the set of presuppositions of the formal alternatives of the sentence, generated by Katzir’s [77] procedure, (ii)  $k$ , the background information used, is DS, (iii)  $G$  is the maximal conjunction (intersection) of those propositions in  $\mathcal{H}$  that are innocently includable. Of course, the crucial point is that this is not only a theory of accommodation, but a general theory of implicature and accommodation, where the two dimensions crucially compete with and constrain each other. It thus has consequences not only for the theory of presupposition, but also for the theory of implicature. In this section, I would like to discuss two main issues related to the general architecture of grammatical inference developed here. First, since my proposal aspires to be a theory of implicature, accommodation, and their interaction, I would like to discuss how this system relates to the system of Gazdar [41], the major extended theory of the interaction between presupposition and implicature.<sup>32</sup> Second, it is known that extra-grammatical factors *do* influence inferences such as presupposition accommodation. For instance, I currently predict that when both the conditional presupposition  $\phi \rightarrow \psi$  and  $\psi$  are available for accommodation, we should generally prefer to accommodate  $\psi$ . But much of the difficulty surrounding the proviso problem stems from the fact that this is just not so (eg. Geurts’ scuba diver/wetsuit cases). I will try to

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<sup>31</sup>See also Gajewski [38], Fox and Hackl [35], Magri [88], Chierchia, Fox, and Spector [17] for discussion of some of the properties of this system.

<sup>32</sup>I will leave for future occasion a discussion of various more recent proposals for dealing with the interaction of implicature and presupposition (eg. Chierchia [16], Katzir [75], Russell [101], Simons [114], Chemla [15], Sharvit and Gajewski [112]).

clarify as much as I can at this point the nature and extent of such interactions.

### 5.3.1 Brief Comparison with Gazdar

We briefly discussed Gazdar's [41] system in Section 4.2. The main tenets of this theory were:

- any given sentence has a set of potential implicatures
- any given sentence has a set of potential presuppositions
- the system updates the context  $c$  by adding as many potential implicatures it can to  $c$  while maintaining consistency, creating a new context  $c'$
- it then adds as many of the potential presuppositions as it can to the context  $c'$ , while maintaining consistency

This algorithmic theory of inference differs from our proposal along several dimensions. Let me try to highlight just some of these dimensions of variation. First, putting aside any differences in the set of potential implicatures, our theories have different sets of potential presuppositions. For Gazdar, these were all and only the presuppositions of the constituents of the asserted sentence. Thus, for a sentence like 'if  $\phi$ , then  $\psi_p$ ,' there was only one potential presupposition:  $p$ . For us, we have both the projected presupposition  $\phi \rightarrow p$ , and the alternative  $p$ . Now for Gazdar,  $p$  could in principle be cancelled by implicature, for instance when the antecedent itself is equivalent to  $p$ . In our proposal, the basic semantic presupposition is never cancelled. So when the assertion is 'if  $\phi$ , then  $\psi_p$ ,' the context has to entail  $\phi \rightarrow p$ . There is no cancellation of this requirement. When the context doesn't entail this proposition, you have to accommodate at least  $\phi \rightarrow p$ . This was encoded in our constraint that all the set of innocently includable propositions have to include the semantic presupposition as a member. In this particular case, my system and Gazdar's both find themselves asking whether  $p$  will also be inferred, subject to consistency with implicatures, but it is important to note that conceptually, we come to this point through quite different paths.

It turns out that this conceptual difference leads to empirical consequences as well. For instance, let's return to examples (6) and (7) from Section 4.2:

21. If John paid his bill today, his payment should arrive by tomorrow
22. If John made a payment, the fact that he paid his bill on time makes me happy

Recall that the satisfaction theory predicts (21) to presuppose nothing. Hence the question of accommodation simply doesn't arise. Gazdar's system on the other hand predicts (21) to presuppose that John made a payment. Application of the HWAMT seems to not be conclusive:

23. ? Hey wait a minute! I didn't know John made a payment!

This unclear HWAMT is not predicted by either the satisfaction theory or Gazdar's system. For the satisfaction theory there is no presupposition, so nothing justifies the objection. It should be clearly bad, especially since the proposition that John made a payment isn't even entailed by (21). But the HWAMT is not obviously infelicitous here. In Gazdar's system there is no implicature of this sentence that can cancel the potential presupposition that John made a payment, and thus the HWAMT should be clearly felicitous.<sup>33</sup> In this example I share Gazdar's prediction. Even though the sentence itself is presuppositionless, it has an alternative (the consequent) which has a presupposition. This presupposition (that John made a payment) then enters  $\mathcal{H}$  as a proposition to accommodate.<sup>34</sup> Since there is also no proposition in  $\mathcal{N}$  that would create a symmetry problem with this proposition, we predict that it will be accommodated. We should thus be able to *HWAM!* this proposition. To the extent that it is possible to do so, we have an account of this that wasn't available for the basic satisfaction theory. To the extent that it seems difficult to *HWAM!* this, we are left with a gap in the explanation. We might speculate that when we

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<sup>33</sup>Assuming here that we interpret Gazdar, against his own intentions, as taking presuppositions to be constraints on the context prior to update with the assertion. If our arguments in favour of the common ground theory of presupposition from Section 4.1. are sound, then this distortion of Gazdar's intended interpretation of this theory would seem to be necessary.

<sup>34</sup>cf. Also our discussion of examples (18) and (19).

accommodate a proposition only because of the presuppositions of alternatives, and not because the sentence itself suffers from presupposition failure, the objection is not as felicitous (since the hearer didn't violate norms of assertion, *per se*). But this is only a speculation at this point, and I have nothing more to say about this datum at this point.

With respect to (22), we are able to avoid the Soames/Heim objection to Gazdar's prediction concerning this example. Because that system does not make available a conditional presupposition, it only predicts that the presupposition of the consequent (that John paid his bill on time) will be cancelled by the clausal implicature that the speaker is ignorant about whether John even paid his bill. Since presupposition cancellation is a matter of course in Gazdar's system, there is no account of the oddness. The satisfaction theory has a ready account of the oddness. The proposition that the hearer is expected to accommodate is at least potentially controversial (that if John paid his bill, he paid it on time), and it is generally bad conversational practice to introduce controversial and surprising information into the discourse through presuppositional means. We generate both the conditional presupposition and the presupposition of the consequent. Like Gazdar, we predict that the presupposition of the consequent will not survive. But unlike Gazdar, we still have the conditional presupposition available to us. Thus, we can appeal to Heim's [56] account of the oddness of the sentence.

Let me point out just one more potentially interesting point of difference between my proposal and Gazdar's. Recall that we predict bidirectional influence between potential implicatures and potential accommodations, while Gazdar generally predicts only that implicatures can cancel presuppositions. I say 'generally' because he does stipulate one exception. If a constituent  $p$  occurs as a presupposition of some constituent containing  $p$ , then  $p$  is exempt from the generation of 'clausal implicatures'  $\diamond_{sp}$ ,  $\diamond_{s-p}$ . Note right away that this means Gazdar cannot account for the fact that we *do* get speaker ignorance inferences with conditional complements to *know*, as discussed in Section 4.3.2. Recall that this motivated our solution to the proviso problem in the first place. Although Gazdar does not run into a proviso problem

with conditionals embedded under *know*, his system remains unable to generate the required speaker ignorance inferences. So why did he impose such a restriction? In order to account for the fact that although *Mary is cheating on him* is a constituent of the entire conditional in (24), there is no ignorance inference concerning its truth. Instead, the presupposition seems to be inherited by the entire clause:

24. If John flies to Toronto, he'll know Mary is cheating on him

For Gazdar, then, implicatures cancel presuppositions unless the presupposition is represented as a constituent. In such cases, the presupposition cancels the potential clausal implicature that the constituent would normally give rise to if not in a presuppositional environment. Again, if this assumption can be made, then Gazdar loses the capacity to derive the ignorance inferences for conditionals under *know* discussed in Section 4.3.2.

How do we fare with these cases? It seems that we predict ignorance inferences concerning the proposition that Mary is cheating on John. This is because we will have this proposition in  $\mathcal{H}$  (through factivity of the consequent, which is an alternative to (24)), and we will have the negation of this proposition in  $\mathcal{N}$  (because *Mary is cheating on him* is an alternative to (24)). We will thus be in a case of symmetry, and so the two will cancel each other out. This looks like a bad prediction. To see that it might not be, consider the fact that in the following dialogue, we do get an ignorance inference concerning the complement of *know*:

25. A: Where are we?

B: Well, if we're on Rte. 183, I know we're just outside Lockhart.

It is clear that the speaker is ignorant about whether they're in Lockhart or not. What's the difference between (24) and (25)? To answer this question, we need to turn our attention to the interactions between *DS* and external systems.

### 5.3.2 Relevance

I would like to suggest that what is responsible for the difference is *relevance*. Since Rooth [100], it has been argued that the space of alternatives used in conversational

reasoning is a product of two sources: (i) The space of formal alternatives generated by the grammar, (ii) Relevance. More specifically, the actual alternatives will be some subset of (i) restricted by relevance. In recent work, Danny Fox and Roni Katzir (Fox [32], Fox and Katzir [36], Katzir [76]) have argued that the space of alternatives to sentence  $\phi$  for both focus and implicatures is:  $ALT(\phi) \cap \mathbf{REL}$ , where  $\mathbf{REL}$  is a set of relevant propositions. I will not rehearse the arguments for such a move here. I follow them without comment, and refer the reader to their work in progress for details, and for various proposals concerning closure conditions on the set  $\mathbf{REL}$ .

Let me now fix some notation. Let  $ALT_R(\phi) = ALT(\phi) \cap \mathbf{REL}$ , and let  $A_R(\phi)$  be that subset of  $A(\phi)$  whose sentences denote propositions in  $ALT_R(\phi)$ . Then we have the following modified sets of alternatives in our procedure:

**Alternatives for Reasoning, Final Version**  $\mathcal{N} = \{\neg p : p \in ALT_R(\phi)\}$ , and  $\mathcal{H} = \{\pi(\psi) : \psi \in A_R(\phi)\}$ .

We can now avoid the prediction of ignorance in (24) = ‘if  $\phi$ , then  $K_j\psi$ .’ If  $\psi$  is irrelevant, then  $ALT_R(\phi) = \{\text{if } \phi \text{ then } K_j\psi, \phi, \neg\phi, K_j\psi, \neg K_j\psi\}$ . In the presuppositional domain, we will have  $\mathcal{H} = \{\phi \rightarrow \psi, \psi\}$ . Our inference system will now produce the following inferences: (i) That Mary is cheating on John (accommodation from  $\mathcal{H}$ ), (ii) That the speaker is ignorant about whether John will fly to Toronto ( $\phi$  is not innocently includable), (iii) That the speaker is ignorant about whether John knows that Mary is cheating on him ( $K_j\psi$  is not innocently includable). There is no longer any ignorance inference concerning the complement of *know*.

A question that remains is: why do we prefer to read (24) as taking place in a context where  $\psi$  is not relevant? I do not have an answer to this.<sup>35</sup> I cannot say, in general, when a proposition will or will not be relevant. The only prediction I do make is the following. Let’s restrict our attention to structures like (24) = ‘if  $\phi$ , then  $K_j\psi$ .’ Whenever we can be sure that the complement  $\psi$  is relevant (say, it is a cell

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<sup>35</sup>We might speculate, following Fox [31], that there might be a general pressure to minimize ignorance inferences. Fox speculates that some such pressure might provide a functional motivation for his exhaustive operator. If the pressure is real, we might expect it to determine our decisions concerning relevance, as well.

in a partition in the sense of Groenendijk and Stokhof [50] or Lewis [87]), then we will get ignorance inferences about  $\psi$  because of symmetry (we get  $\neg\psi$  in  $\mathcal{N}$  and  $\psi$  in  $\mathcal{H}$ ). For instance, if we make the topic-focus structure explicit, say by embedding an it-cleft under *know*, we predict that the cleft’s presupposition should be inherited by the entire conditional, but there should be ignorance about the asserted content of the cleft. This looks right to me:

26. If there’s lipstick on the typewriter, then I know it was Sam who broke it.

Gazdar’s formulation of the interaction between clausal implicatures and represented presuppositions would predict (26) to presuppose both that the typewriter was broken (as we do) and that Sam broke it (for which we predict ignorance). We’re clearly in the right, here.

We can now return to (30) from the end of Chapter 4, which we repeat here as (27):

27. A: How much has Mary figured out about you?

B: Well, not much. But she does know that if I have a sister, I slept with her best friend last night.

We wanted to show that when only Mary’s knowledge is relevant, there is no accommodation of the stronger alternative *despite the fact that it’s formally present in the set of alternatives for accommodation*. Letting  $S = K_\alpha(\text{if } \phi, \text{ then } \psi)$  be the asserted sentence, we have  $A_R S = ALT_R(S) = \{K_\alpha(\text{if } \phi, \text{ then } \psi), K_\alpha\phi, K_\alpha\neg\phi, K_\alpha\psi, K_\alpha\neg\psi\}$ , and  $\mathcal{H} = \{\text{if } \phi \text{ then } \psi, \phi, \neg\phi, \psi, \neg\psi\}$ . There is no implicature or anything that will block accommodation of  $\psi$  here. However, what happens here is that the members of  $\mathcal{H}$  create symmetry problems for each other. Since  $\mathcal{H}$  contains both  $\psi$  and  $\neg\psi$ , this stronger proposition simply cannot be accommodated. Now that we’ve developed a full theory of accommodation, we see that we don’t even need to appeal to ignorance inferences/implicatures even when the complement is relevant (as we did in the response to Geurts’ original case). This sets us apart from the systems proposed by Heim/Pérez Carballo/van Rooij and others. In fact, we can drop

Heim’s Principle entirely. We don’t need ignorance inferences/implicatures to cancel presuppositions. This can sometimes happen as a special case, but otherwise, we have alternative implicatures and accommodations, and these can sometimes create symmetry problems for each other. The only implicatures and accommodations you get are those that are innocently includable. As a result, even when we don’t get certain implicatures or ignorance inferences due to lack of relevance, we can still predict the blocking of various alternative accommodations, so long as the set of alternative accommodations creates symmetry problems itself.<sup>36</sup>

This foray into relevance has given us an opportunity to introduce the second main point I wish to discuss in this section, namely, the interaction between extra-grammatical information and the formal deductive system *DS*. We’ve isolated one such interface principle: Following Fox and Katzir, we assume that the set of alternatives available for reasoning is restricted by relevance. Relevance, being non-grammatical by definition, is one factor in conversational reasoning (with obvious roots in Gamut [39] and Rooth [100]). I would like now to try to isolate a few more such extra-grammatical factors that interact with *DS* in some seemingly systematic manner.

### 5.3.3 Error Correction

Suppose the set of innocently includable propositions is  $M = \{p_1, \dots, p_k\}$ . We stated earlier that the grammar will recommend (prefer) that the entire set be inferred (i.e. infer the conjunction of the members of  $M$ ). Now in both implicatures (eg. Gamut [39]) and presupposition (eg. Kay [78]), it has been argued that if the speaker is

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<sup>36</sup>It seems that it is not so easy to allow relevance reasoning to prune the set of formal alternatives as one may have thought. For example, the following sentence seems destined to always be odd: # If I have a sister, I (definitely) dated many of her friends. We might try imposing certain constraints on alternatives that ensure that each constituent in a conditional of this sort is (necessarily) relevant. Fox and Katzir suggest that the set of relevant alternatives is closed under negation and conjunction. We can get the required relevance if we add to this the following closure condition: If  $\psi$  is relevant, and  $\psi$  is equivalent to some Boolean combination of other members of the formal alternatives  $\phi_1, \dots, \phi_k$ , then  $\phi_i$  is relevant,  $1 \leq i \leq k$ . For instance, the conditional  $\phi \rightarrow \psi$  is relevant (because it was asserted), and it is equivalent to  $\neg(\phi \wedge \neg\psi)$ . Hence,  $\phi$ ,  $\psi$ , and their negations, would also be relevant. Such forced relevance of constituents of the conditional would not be possible under *know*, since  $K(\phi \rightarrow \psi)$  is not equivalent to any Boolean combination of its formal alternatives.

taken to not be opinionated about  $p$ , then that suffices to block any inference to  $p$ . What I will propose is that in all such cases, the set  $M$  is pruned by eliminating  $p$ , i.e. a contextual assumption that the speaker is not opinionated about  $p$  converts  $M$  to the set  $M - \{p\}$ . This seems to suggest that certain contextual assumptions can act as ‘error correction’ devices, in that when the grammar’s greed for information oversteps what is pragmatically warranted, there are mechanisms in place to temper the grammar’s greedy conclusions. The architecture thus seems to share certain properties in common with certain proposals in the theory of linguistic performance, such as the parsing model developed by Crain and Steedman [19]. Here, the parser makes various decisions ‘blind’ to contextual information, but then ships them off to the contextual reasoner which can then either approve, or correct the parser’s decision if it ‘doesn’t make sense.’

Another case of error correction seems to show up in some cases of presupposition accommodation. Consider the case of presupposition accommodation in conditionals ‘if  $\phi$ , then  $\psi_p$ .’ We predict that the space of candidates for accommodation is  $\mathcal{H} = \{\phi \rightarrow p, p\}$ . Let’s suppose that both members of  $\mathcal{H}$  are innocently includable. Then we predict that there should be a general preference to accommodate the conjunction of the propositions, which, since the set is totally ordered, is equivalent to accommodating the stronger proposition  $p$ . This seems to quite generally hold true, and would seem to derive Heim’s [55] stipulated preference for ‘global’ accommodation.<sup>37</sup> But we have seen some cases where this doesn’t quite happen. Here is the one we introduced from Geurts [43]:

28. If John is a scuba diver, he’ll bring his wetsuit

Why don’t we accommodate that John has a wetsuit? Well, first, note that we can accommodate this. The hearer is always licensed, I think, to HWAM! the grammar’s recommended accommodation:

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<sup>37</sup>Of course my proposal is a proposal about global accommodation. What I mean by this is that the reading predicted by global accommodation in a system that includes options as to which context to accommodate in will, in various cases, fall out as equivalent to the accommodation that’s predicted by my system. I will have to leave a detailed discussion of this relation for future work.

29. S: If John is a scuba diver, he'll bring his wetsuit

H: Hey wait a minute! I didn't know John has a wetsuit!

One can blame the hearer for having made the wrong conclusion here, but she is not entirely to blame for the miscommunication, either. Nevertheless, there is a very strong preference to accommodate, instead, simply that if John is a scuba diver, he has a wetsuit. Hence, we are not forced to accept the grammar's recommendation. Can we say something about when this happens?

I would like to suggest that we find such cases of dissent when, upon checking world knowledge, we find that accommodating the grammar's recommendation would simply be gratuitous. If  $\mathcal{H}^*$  is the set of innocently includable propositions in  $\mathcal{H}$ , then *DS* tells you to accommodate them all. If upon checking world knowledge you see that there are propositions in  $\mathcal{H}^*$  that would hold by virtue of deeply entrenched beliefs (usually those expressible as lawlike, generic statements, eg. *scuba divers have wetsuits*), then there is a way to render the sentence felicitous without having to seriously update your beliefs. By assuming that the lawlike statements hold, no further accommodation would be necessary. Thus, a general constraint along the lines of 'Minimize Belief Update,' familiar from the belief revision literature, seems to counter *DS*'s hunger for information. Another case of this kind of correction is evident in cases like the following, discussed in Geurts [43] and Singh [116]:<sup>38</sup>

30. If John is a scuba diver and wants to impress his girlfriend, he'll bring his wetsuit

**Semantic Presupposition** If John is a scuba diver and wants to impress his girlfriend, he has a wetsuit

**Pragmatic Presupposition** If John is a scuba diver, he has a wetsuit

One may at this point ask what exactly the difference is between: (1) a system that first generates a strong proposition for accommodation within the grammar, only to possibly be weakened by the assumption that some member(s) of  $\mathcal{H}$  instantiate

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<sup>38</sup>Although Geurts brought this up as a difficulty to the satisfaction theory, it's not at all clear how his preferred DRT alternative could capture the attested accommodation.

lawlike statements, and (2) a system that generates candidates, and decides between them based on plausibility, of the sort advocated by Beaver [4], Beaver and Zeevat [9], von Stechow [25], Heim [60], and Pérez Carballo [94]. First, a system of the latter sort does not readily capture the apparent fact that, as a default, we do prefer the strongest proposition. One way to see that this is a default is to note that it often takes ‘special contexts’ to get something other than the strongest. By ‘special context,’ I mean having to state explicitly that the speaker is unopinionated about this or that proposition (or constructing strange contexts where this would be implied), or cases of the scuba-diver/wetsuit sort. Most conditionals, presented out of the blue, in out of the blue contexts, will generate the strongest accommodation. Moreover, even in the complicated cases, the stronger accommodation is always licensed. But not so the other way around. For example, to get (31) to be read with a conditional presupposition, one will pretty much have to create a special context (as Heim [60] does):

31. If John flies to Toronto, his sister will pick him up from the airport

Finally, when subjects are presented with nonce terms, they find themselves in a peculiar kind of ambiguity:

32. If John is a kabbaddi player, he’ll bring his chappal.

The sentence seems to be conveying one or the other of the following: (1) John has a chappal (whether he’s a kabbaddi player or not), (2) He has a chappal only on the condition that he’s a kabbaddi player, under the assumption that kabbaddi players in general have chappals. Informants reliably volunteer these judgments, and when they don’t volunteer this ambiguity, they readily assent to it when asked.<sup>39</sup> I take this and the other remarks above to be teaching us that there is a default preference for the strongest accommodation, which can be overridden if the semantic presupposition instantiates a lawlike statement or other deeply entrenched information.

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<sup>39</sup>It is probably this that is behind Beaver’s [4] judgment that you sometimes accommodate information of a more general, lawlike form. The idea would be that there are certain conditions under which the grammar’s recommendation can be rejected, with deeply entrenched lawlike knowledge being one such potential factor. I’ll come back to such cases in Section 5.3.5.

### 5.3.4 Objecting in Discourse

Architecturally, this suggests that there is a stage of interpretation that evaluates the output of the grammar and decides whether to accept it, or reject some or all of it. Interestingly, such a stage of processing has also been proposed by Kai von Stechow [24]. With respect to differing truth-value intuitions in cases of presupposition failure (intuitions of falsity versus ‘squeemishness’), von Stechow suggests that the differing intuitions come from two different ways in which the utterance can be challenged. First, one can object to the presupposition failure itself via the HWAMT. Second, von Stechow lays out conditions under which it is also possible to challenge the utterance despite the presupposition failure. The essential idea is that if one can show that the sentence has no chance of being true independent of the presupposition itself, then that can give rise to a judgment of falsity. For example, *the king of France is sitting in that chair* (said pointing at an empty chair) can be judged false, because it has entailments that can be falsified independently of discussing its presupposition. Much effort is spent in spelling out precisely when such independent ‘footholds for rejection’ can and cannot be established. What is important for us to note here is that when you are faced with presupposition failure and wish to object, there are two routes available to you: (i) Object based on the presuppositional information alone, (ii) Object based on independent entailments of the sentence. This will be important for us because, as noted in Section 5.2.1, there are some complications to our understanding of the HWAMT and its use in various contexts. Let me turn to some of these now.

First, recall the following examples from Section 5.2.1:

33. Context: It is common knowledge that John has a dog if and only if he has a German Shepherd.

S: John is out walking his dog.

H: # Hey wait a minute! I didn’t know John has a German Shepherd!

34. Context: Modern society.

S: Since John was once president, his daughter must have gone to Yale or Harvard.

H: #Hey wait a minute! I didn't know John has a white daughter!

On the basis of such examples, I made the following argument. Since John's having a dog is contextually equivalent to his having a German Shepherd, then since accommodation of either proposition would have the exact same effect on the common ground, they should (given common knowledge) be equally good candidates for accommodation. However, only the HWAM with the proposition that John has a dog is felicitous. Since this is the semantic presupposition of the sentence, and assuming the HWAMT targets whatever it is that the hearer is supposed to be accommodating, the proposition that John has a German Shepherd just isn't available. And similar arguments apply for the case of John's daughter. The semantic presupposition is that John has a daughter. But, given common knowledge, this is equivalent with John having a white daughter. But only the former is felicitous in the HWAM environment. I concluded from this that John's having a white daughter is simply not available. In accommodating, we must be blind to what we know. That the argument doesn't go through in its entirety was first brought to my attention by Noam Chomsky (p.c.), who brought up the following slight variation on (34):<sup>40</sup>

35. Context: We live in a society where there is lots of adoption, and only white people go to Yale and Harvard.

S: Since John was once president, his daughter must have gone to Yale or Harvard.

H: Hey wait a minute! I didn't know John has a white daughter!

H: Hey wait a minute! I didn't know John has a daughter!

In this case, since we know (by presupposition) that John has a daughter, and (by assertion) that she went to Yale or Harvard, then we know (given our common knowledge that only white people go to Yale/Harvard) that John has a white daughter. Thus, John's having a daughter and his having a white daughter are contextually

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<sup>40</sup>Several people found additional such cases: Donka Farkas, Kai von Fintel, Danny Fox, Andrea Gualmini, Irene Heim, Roni Katzir, and an anonymous reviewer for SALT. I think that what I say about Chomsky's example carries over to these others, so I'll focus on that one.

equivalent. However, only one of them (that John has a daughter) is the semantic presupposition, and so, by parity of reasoning (with our argument above), we seem to predict that only that should be felicitous in a HWAM environment. But the prediction is false. It is fine in this context to HWAM John's having a white daughter. Why?

First, it is not at all clear to me that the HWAM in this case is the same 'move' as the ones we saw earlier. Intuitively, it does not feel like the same kind of objection. It feels more like 'Oh shit! That's surprising! I didn't know that John has a white daughter!' But since I have no good way to flesh out this intuition, I will not pursue this any further. However, I would nonetheless like to suggest that whatever kind of objection it is, it seems to be the second of von Fintel's routes to objection at work here. The hearer can establish various entailments of the sentence that follow from properties independent of the presupposition itself. Whenever she can do this, the HWAMT for such entailments seems to work fine.

Here is that I mean. Imagine that the hearer is constructing proofs of various claims, employing various axioms in her reasoning. In (35), how might she come upon the conclusion that John has a white daughter? Here is a proof:

36. Presupposition: John has a daughter  $x$

Assertion:  $x$  goes to Yale or Harvard

Independent Information: Only white people go to Yale/Harvard.

Therefore, John has a white daughter

Crucially, the independent information has nothing to do with whether John has a daughter or not.

It turns out that we can't construct any such proof in (33) and (34). For example, in (34), the independent information needed in the proof would be that only white people have been presidents of the United States. But the rest of the sentence (other than the presupposition inducing NP *his daughter*) is unrelated to this. The predicate  $\lambda x.x$  went to Yale or Harvard stands in no deductive relationship with the information that all presidents have been white. And this seems to be enough to block a HWAM

of John having a white daughter. More generally, a HWAM of a sentence's entailment that is stronger than the presupposition seems to be licensed only if a proof of the form in (36) can be found.

Of course, this is not an explanation, but an attempt at characterizing the class of HWAMTs that are felicitous even when targeting propositions that my system cannot generate as recommended accommodations. Here is a way of cashing out this intuition. Let us focus on the contrast between (34) and (35). Kai von Fintel (p.c.) and Danny Fox (p.c.) have suggested to me that the HWAM in (34) has an implicature, namely, that I (the objector) didn't know (at the time of the utterance  $t$ ) that John has a daughter. This is all computed within the grammar, generating the meaning that I didn't know (at  $t$ ) that John has a white daughter but that I did know (at  $t$ ) that he has a daughter. This information then contradicts our common knowledge that it was common knowledge (at  $t$ ) that John has a daughter if and only if he has a white daughter. When blind scalar implicatures generate meanings that conflict with common knowledge, the result is a certain kind of oddness (Fox and Hackl [35], Magri [88], with roots in Heim [57]). We'll get back to this form of oddness in the next chapter when we return to *Maximize Presupposition!* For now, what is important to note is that this contradiction is not present in (35) (Kai von Fintel, p.c.). Recall that in (35) it is the sentence itself that is responsible for the contextual equivalence. At the time of the assertion  $t$ , it was not common knowledge that John has a daughter if and only if he has a white daughter. We only learn this from the sentence itself, which tells us that John has a daughter and that she went to Yale or Harvard. Thus, the contextual equivalence only arises at some later time  $t'$  (say, the time of accepting the information entailed by the sentence). Hence, when I object with a HWAM, giving rise to the meaning that I didn't know (at  $t$ ) that John had a white daughter and that I did know (at  $t$ ) that he had a daughter, no inconsistency arises, and so there is no oddness to the HWAMT.

What this suggests is that there might not be any argument from the HWAMT to support the claim that the alternatives for accommodation are restricted in the way I proposed in Section 5.2.1. As far as the HWAMT goes, it could well be that

accommodation is entirely unrestricted, and that the distribution of felicitous HWAM objections can be accounted for once implicatures are taken into account. The correct felicity conditions of the HWAMT might state that it can probe some subset of the non-asserted entailments of a sentence, perhaps along the lines I vaguely suggested earlier, following up on von Stechow's suggestions about the mechanisms of rejecting various sentences.

I don't think this line of explanation will work, in general. I don't think it will work because we can often HWAM non-entailed propositions, but only those that are members of our restricted hypothesis space. For example, we saw that (35) entails both that John has a daughter and that John has a white daughter. We also saw that the HWAM objection works in each case. However, if we embed (35) in a question, say, or the consequent of a conditional, we again infer both that John has a daughter, and that he has a white daughter, but only one of them (the one that is a member of my proposed hypothesis space, viz. that John has a daughter) can occur in a HWAM environment (assume we are in Chomsky's context of (35)):

37. S: Since John was once president, do you think his daughter went to Yale or Harvard?

H: # Hey wait a minute! I didn't know John has a white daughter!

H: Hey wait a minute! I didn't know John has a daughter!

38. S: If John was once president, his daughter must have gone to Yale or Harvard

H: # Hey wait a minute! I didn't know John has a white daughter!

H: Hey wait a minute! I didn't know John has a daughter!

In these examples, neither John having a white daughter nor John having a daughter are entailed or (semantically) presupposed. But we infer them in each case. However, the only legitimate HWAM objection here is to John's having a daughter, not to his having a white daughter. Importantly, an account in terms of implicatures and consistency will not work here. In this context, it is quite consistent (as it was with (35)) for the hearer to know (at the time of utterance) that John has a daughter without knowing that he has a white daughter.

Danny Fox (p.c.) has suggested that HWAM objections might be odd if the resulting implicature entails the presupposition itself. This would make the objection a self-refuting objection, if it is grounded in the fact that there is a presupposition failure at the time of utterance. For example, the semantic presupposition in (37) is that the hearer thinks John has a daughter, while in (38) the semantic presupposition is that if John was once president, he has a daughter. If the hearer's utterance *Hey wait a minute! I didn't know John has a white daughter!* implicates that she knew that John has a daughter, this would entail the semantic presupposition in each case. The objection would be self-refuting, then, and this would be the source of the oddness. What happens in Chomsky's case is that John's having a white daughter is entailed by the sentence in the sense discussed earlier, whereas it isn't in (37) and (38), and for whatever reason, we can get away with such HWAM objections in such cases. We still don't quite understand why these sorts of entailments can lead to felicitous HWAM objections, nor do we quite have a proper characterization of them. But we at least have an initial stab at characterizing this complex of facts.

Let me try to summarize where we are. We have a certain distribution of HWAM objections. We also have two proposals on the table in accounting for them. One, my proposal from Section 5.2.1, proposes that the HWAMT teaches us that there are restricted alternatives for accommodation, so that an objection *HWAM! I didn't know that p!* will be felicitous only if: (i) *p* is a formal alternative for accommodation, (ii) *p* is an entailment of the sentence in a way yet to be understood. The second proposal is consistent with there being no restrictions on alternatives. In principle, anything can be accommodated. But the HWAMT doesn't necessarily argue for formal alternatives. The objection, *HWAM! I didn't know that p!*, will be felicitous if: (i) *p* is an accommodation, and the objection is not self-refuting (i.e. does not entail the semantic presupposition itself), (ii) *p* is an entailment of the sentence in a way yet to be understood. Under both proposals, (ii) remains something of a mystery. We can thus ignore it for purposes of theory comparison, and focus on (i). What we need are cases where we infer *p*, and the objection *HWAM! I didn't know that p!* is not self-refuting. What we find is that, in such cases, whenever *p* is a member of my

proposed hypothesis space for accommodation, the objection works fine, and when  $p$  is some other inference, the objection doesn't:

39. Context: As in Chomsky's example (35), and Mary knows John and his family quite well.

S: Mary doubts that John's daughter got into Harvard

**Semantic Presupposition** Mary believes John has a daughter

**Inference 1:** John has a daughter

**Inference 2:** John has a white daughter

H: # Hey wait a minute! I didn't know John has a white daughter! (Implicature: The hearer knew that John has a daughter)

H: Hey wait a minute! I didn't know John has a daughter!

40. Context:<sup>41</sup> The speaker is a crazed Chomskyan (a 'true believer,' as some might say), and when he tries to get people to read linguistics, he only gives them books by Chomsky. He somehow doesn't know that Chomsky also has a second life outside of linguistics, and so knows nothing about his media analysis, political commentary, etc. Thus, assume we have the following contextual equivalence: The speaker gives away linguistics books iff he gives away books by Chomsky.

S: The linguistics book I gave to Mary is interesting.

**Inference 1:** I gave a book about linguistics to Mary

**Inference 2:** I gave a book by Chomsky to Mary

**Semantic Presupposition:** I gave a book about linguistics to Mary

H: # Hey wait a minute! I didn't know Mary got a book by Chomsky! (Implicature: The hearer knew Mary got a book)

H: Hey wait a minute! I didn't know Mary got a book about linguistics! (Implicature: The hearer knew Mary got a book)

In each case, we have at least two inferences, neither of which is semantically presupposed by the sentence. Thus, they must follow from some inference mechanism, either accommodation, or something else. Now when the hearer tries to object to the

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<sup>41</sup>This is a slight modification of an example from Danny Fox, p.c.

different inferences, the implicature does not entail the semantic presupposition in any of the objections. Thus, it is not a self-refuting objection. Nor does it result in a conflict with the prior context. For example, in (39), the objection *Hey wait a minute! I didn't know John has a white daughter* gives rise to the implicature that I did know that John has a daughter. But this stands in no logical relationship with Mary's belief that John has a daughter, and so the objection is not self-refuting. Similar remarks apply to (40). We can conclude as a result that the only remaining explanation is that the HWAM objection works so long as the proposition being objected to is a formal alternative. This argues in favour of my claim that the HWAMT *does*, after all, provide evidence in favour of the view that there are formal alternatives for accommodation. Of course, the HWAMT can sometimes be applied to other entailments of the sentence, in a way yet to be understood. But currently, our best answer for the distribution of felicitous HWAM objections is one that limits it to formal alternatives for accommodation, plus the mysterious second route to objection (which everyone needs anyhow).

### 5.3.5 Probing the Output of Grammar

One final point I would like to address here concerns the status of inferences like implicature and accommodation. The idea that implicatures are the output of grammar, rather than pragmatics, has been made in the recent literature (Chierchia [16], Fox [31], Fox and Hackl [35], Magri [88], Chierchia, Fox, and Spector [17], Singh [118]). To this I now add that accommodated presuppositions are also the output of grammar, rather than pragmatic reasoning. In fact, my proposal has them following from the same grammatical mechanism of innocent inclusion, with the two tiers mutually constraining one another. Of course, these are architectural conclusions within the theory we've developed. We predict that such information follows from grammar, and since there is non-determinism in the various outputs (eg. with conditional presuppositions out of a conditional construction), we predict that implicature computation/presupposition accommodation involves a form of ambiguity resolution. There is a space of alternatives for implicature and accommodation, and we have

to select from this set. We have postulated that the grammar itself incorporates a particular resolution mechanism, viz. innocent inclusion. This is the grammar's recommendation for the meaning that should be assigned to the given structure. This is then fed to a context-dependent acceptance/rejection system, which can either accept, or reject, the grammar's recommendation. The kind of grammar-context interaction assumed is thus a form of 'weak interaction,' in the sense of Crain and Steedman's [19] theory of parsing. The context doesn't tell the grammar what analysis to select; it can only play a corrective role, accepting or rejecting. We evaluate such a theory in comparison with the predictions of other theories, of course. But what I would like to do now is attempt to find diagnostics that might support or contest the idea that such inferences are indeed the result of ambiguity resolution. Thus, I would like to find evidence suggesting that, in a sentence like *If John flies to Toronto, his sister will pick him up from the airport*, there is an ambiguity as to whether John has a sister or not, but there is no ambiguity as to whether John's sister is nice, say. More generally, the diagnostic I propose below might serve as a diagnostic for ambiguity detection more generally. I will not have occasion to compare my proposed diagnostic with other proposals concerning ambiguity detection.<sup>42</sup> The diagnostic involves certain peculiar properties of the epistemic modal *must*.

Lauri Karttunen [70] first observed that when you learn  $\phi$  by direct observation or reliable testimony, you cannot report it by embedding it under epistemic *must*. Instead, you can only report it by asserting  $\phi$  itself:

41. Context: You look outside and see that it's raining.
  - (a) # It must be raining
  - (b) It's raining

Why should this be? Since Karttunen's paper, this and related facts concerning the use of *must* have received a fair amount of attention (eg. Groenendijk and Stokhof [49], Veltman [132], Kratzer [79], von Stechow and Gillies [26]). What I'd like to take away from these works is the following idea, stated in Karttunen's paper and

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<sup>42</sup>See van Deemter and Peters [20] for a survey.

made most explicit in von Stechow and Gillies [26]. The basic idea is that *must*  $\phi$  is assertable only if  $\phi$  is inferred from indirect evidence (non-observed or not following from reliable testimony). Now, how does linguistic information behave with respect to this diagnostic? It appears that if  $\phi$  is the proposition denoted by the utterance, then it cannot appear as the prejacent of *must*:

42. S: It's raining outside.

H: That's interesting. # It must be raining.

Importantly for us, when a sentence is  $n$ -ways ambiguous between meanings  $m_1, \dots, m_n$ , and say  $m_i$  is the intended meaning, then *must*  $m_i$ <sup>43</sup> will be infelicitous:

43. S: I'm going to the bank. (Intended: Financial Institution)

H: # Oh, you must be going to a financial institution.

44. S: John saw the man with the telescope. (Intended: NP-modification)

H: # Oh, the man must have had a telescope, too.

Of course, if  $p$  is entailed by the intended meaning, then  $p$  also cannot be the prejacent to *must* in these environments:

45. S: John saw the man with the telescope. (Intended: NP-modification)

H: # Oh, the man must have had a technological device.

Noam Chomsky (p.c.) points out that under ambiguities, the *must* sentence will be fine so long as it goes to one of the unintended meanings. For example, in the above examples, we can *must* the other meaning just fine:

46. S: I'm going to the bank. (Intended: Financial Institution)

H: Oh, you must be going to the river today. (eg. say we're in a context where our Bank of America is on the way to the river, and I usually reserve my bank (financial) visits to those days where I also go to the river)

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<sup>43</sup>Thoroughly ignoring sentence/proposition distinctions where irrelevant.

47. S: John saw the man with the telescope. (Intended: NP-modification)

H: Oh, John must have had a telescope.

Thus, when we have an n-way ambiguity, and one of the meanings is intended, we can't *must* that meaning. Other inferences, so long as they're plausible enough, can fall under *must*. For example:

48. S: John saw the man with the telescope. (Intended: NP-modification)

H: # Oh, the man must have had a telescope.

H: Oh, the man must have felt nervous.

If implicatures and accommodation are indeed the output of grammar, we would expect them to not fall under *must*, while other plausible inferences can. Here are examples showing that this is so:

49. A: Who came to the party?

B: SOME of Ling-03 came.

A: #Oh, it must be that all of them didn't come.<sup>44</sup>

A: Oh, it must have been a bore, then.

50. A: If John flies to Toronto, his sister will pick him up from the airport

B: # Oh, he must have a sister

B: Oh, he must have a really nice sister.

It is crucial in these cases that the basic meaning of the asserted sentence does not entail the implicature/accommodation. However, each sentence does come with various inferences. The epistemic *must* test confirms that some of these inferences are given to us by grammar, while the others follow from other forms of rational inference.

The question remains, of course, *why* this modal has this behaviour. More specifically, what is the analysis of *must* that makes it behave in the way it does? As a

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<sup>44</sup>Roni Katzir (p.c.) has suggested that replacing *must* with 'I bet that' helps with naturalness.

universal modal, *must*  $\phi$  should entail  $\phi$ , but then why can't we utter *it must be raining* when we see that it is, in fact, raining? This does not seem to be an idiosyncratic fact about the English lexicon; language after language displays similar behaviour with respect to *must* (von Stechow and Gillies [26]), suggesting that this evidential component of the meaning of *must* should not be arbitrarily stipulated in the lexicon. The fullest attempt I am aware of to provide an answer to this question is found in von Stechow and Gillies [26] (henceforth vFG). They make a proposal that I find rather intriguing: *must*  $\phi$  competes with some alternative,  $\psi$ , which itself entails that  $\phi$  is true, and entails that the speaker has learned  $\phi$  through direct observation/reliable testimony. In their terminology, 'the kernel,' that storehouse of information directly observed or learned through testimony, settles the truth of  $\phi$ . They ultimately reject this proposal for want of an appropriate alternative  $\psi$ . I'd like to suggest here that such an alternative might be  $\psi = !\phi$ , where  $!$  is an *ASSERT* operator such that  $!\phi$  entails that  $\phi$  follows from the speaker's kernel. The use of *must*  $\phi$  would then generate the implicature (within the grammar, of course) that the speaker could not have used  $!\phi$ , from which we would compute that the speaker's kernel does not settle  $\phi$ . Of course, vFG have further arguments against such an analysis, but putting aside the debate for now, such an implicature would then contradict our common knowledge that the speaker's kernel does directly settle the matter of  $\phi$ . For example, when she looks outside and sees that it's raining, it's common knowledge that her kernel settles the question of whether it's raining. The assertion *it must be raining* then generates an implicature that contradicts this common knowledge, and the result of such contradictions is odd. This line of explanation has been put to much use in the literature in service of various claims concerning the architecture of interpretation (eg. Hawkins [52], Heim [57], Magri [88], Fox and Hackl [35], Schlenker [106], Chierchia, Fox, and Spector [17], Singh [118]). With respect to implicatures and presupposition accommodation, the epistemic *must* test teaches us that the linguistic system treats implicatures and accommodated presuppositions as having been directly observed. We have a natural explanation for this: If  $p$  is a proposition generated as the output of the grammar, then it is 'directly observed.' Any other inference, no matter how

plausible, cannot be taken as having been directly observed. For example, this also allows us to distinguish between conditional presuppositions, and the default lawlike statements that seem to give rise to them in the first place:

51. S: If John's a scuba diver, he'll bring his wetsuit

H: # Oh, if John's a scuba diver, he must have a wetsuit<sup>45</sup>

H: Oh, scuba divers must have wetsuits.

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<sup>45</sup>For naturalness, I have put *must* in the consequent, but given Karttunen's [70] observation that such a structure seems equivalent to the reading where the modal outscopes the entire conditional, this is an innocuous move.



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This thesis will argue for four broad claims: (1) That local contexts are needed for a descriptively adequate theory of linguistic interpretation, (2) That presupposition accommodation is made with respect to a set of grammatically defined candidates, (3) That the set of accommodation candidates is derived from the same linguistic objects that are used to derive candidates for implicature (the scalar alternatives of the asserted sentence), (4) That scalar implicatures and accommodated propositions are the output of Fox's [31] procedure of innocent exclusion, modified so as to consider implicature candidates and accommodation candidates together. I argue for claim (1) in Chapter 2 by arguing that Heim's principle of *Maximize Presupposition!* should be checked in local contexts (Local MP). In Chapter 3, I use Local MP to account for an array of blocking effects. We will see that Local MP can help to shed light on the semantics of *only*, counterfactual conditionals, and focus interpretation, as well as highlighting the importance of dynamically changing assignment functions in a theory of interpretation. I argue for claims (2)-(4) in Chapters 4 and 5 by attempting to address the proviso problem (Geurts [43]), as well as a new puzzle for the theory of implicature that arises in the study of attitude ascriptions.