PRESUPPOSITION AND ITS (A-)SYMMETRIES

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To my parents

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ABSTRACT

PRESUPPOSITION AND ITS (A-)SYMMETRIES

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The present dissertation aims to contribute to the investigation of the interaction between truth conditions and the asymmetries inherent in incremental interpretation, through the lens of the (a-)symmetries involved in presupposition 'filtering'.

Our argument is organised as follows: Chapter 1 sets the stage, introducing the problem of (a-)symmetries in natural language and setting out the particular questions involved in the (a-)symmetries of presupposition filtering. These questions are: 1) whether all connectives exhibit a common filtering profile with regards to (a-)symmetries; 2) to the extent that connectives differ in their filtering profiles, whether such differences are a matter of lexical stipulation or can be accounted for in a predictive way. 3) whether predictive theories of filtering in declaratives can be extended to questions. 4) whether different approaches to deriving varying filtering profiles for each connective can be distinguished experimentally. The rest of the dissertation takes up each of these questions.

Chapter 2 consists of an experimental investigation into the differences in filtering exhibited by conjunction vs disjunction. The results of the experiments argue for a difference in the filtering profile of the two connectives: conjunction shows a strong preference for asymmetric filtering, while disjunction a strong preference for symmetric filtering.

Chapter 3 takes on the question whether such differences in filtering must be stipulated as part of the lexical entry of the meaning of connectives, or derived via the interaction of truth conditions with incremental interpretation. Three different systems are developed that opt for the latter route and predict asymmetric filtering for conjunction but symmetric filtering for disjunction. The different systems are contrasted on the basis of a 'test suite' of examples that have received attention in the presupposition literature, and differences in the predictions of the three systems are identified.

Chapter 4 investigates the problem of accounting for filtering patterns in (coordinations) of polar questions. We argue that there are drawbacks to tackling this problem by making the *resolution conditions* for questions asymmetric, and extend one of the systems of chapter 3 to the questions data in a way that avoids this issue.

Chapter 5 represents a first attempt to distinguish experimentally between the three systems developed in chapter 3. It focuses on conjunctions whose first conjunct is negated and carries a presupposition. One of the systems developed in chapter 3 predicts the availability of symmetric filtering in this case, whereas the other two systems predict the opposite. While the results point to symmetric filtering being available in these conjunctions at least for some triggers, coming up with a design that was completely confound-free proved hard. As a result the results are somewhat inconclusive and the chapter ends by proposing modifications to our experimental designs that will hopefully provide a clearer picture in the future.

Chapter 6 concludes, summarizing the main findings of the dissertation and setting out a future research agenda on the problem of presupposition and its (a-)symmetries.

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Introduction

1.1. Preliminaries

The present dissertation consists of four papers, all of them concerned with some facet of the problem of the (a-)symmetries of presupposition projection. While each chapter is in principle independent of the others, they are linked by a common theme, and as a result, various background notions appear repeatedly, but developed to different levels of detail according to the demands of each paper.

This introductory chapter has three aims: First, to state the big-picture issues that are at stake in the general problem of (a-)symmetries in natural language (of which the (a-)symmetries of presupposition are one influential instantiation). Second, to set in place some of the background notions that will keep making an appearance across the different chapters. Finally, to give a bird's-eye-view of the structure of the dissertation, summarizing how the chapters relate to the big-picture questions we introduce here, and fit into a coherent whole.

We start with the general problem of (a-)symmetries in natural language and what its consequences are for theories of our knowledge of language.

1.2. Dynamic effects in language: grammar or processing?

Commutativity In modeling the semantics of operators like conjunction and disjunction through the boolean $\wedge$ and $\vee$ of classical logic, we commit ourselves to the claim that conjunction and disjunction are commutative. Commutativity refers to a kind of **symmetry**: that is, the order in which the conjuncts/disjuncts appear does not matter. Natural language should mirror the commutativity of classical logic $(p \wedge q) = (q \wedge p)$, and $(p \vee q) = (q \vee p)$. And most of the time, this seems to be the case:

(1) a. John likes listening to Bach and he likes listening to Mozart.

b. John likes listening to Mozart and he likes listening to Bach.

(2) a. John likes listening to Bach or he likes listening to Mozart.

b. John likes listening to Mozart or he likes listening to Bach.

The pairs of sentences in (1) and (2) are equivalent, despite the difference in order. Nevertheless, there are cases when this equivalence appears to break down.

Asymmetries Consider the following well-known cases:

(3) a. Mary got married and got pregnant.

b. Mary got pregnant and got married.

(4) a. [A man]$_i$ walked in and he$_i$ was wearing a hat.

b. # He$_i$ was wearing a hat and [a man]$_i$ walked in.

In all of the pairs of sentences the (a) sentence and the (b) sentence are not equivalent: in (3), the difference is one of temporal order: in the (a)-sentence there is a strong sense that Mary first got married and then she got pregnant, whereas in the (b)-sentence these two events happened in the opposite order. In (4), the conjunction is felicitous in the (a)-order, but not in the (b)-order. Therefore, these conjunctions are asymmetric in the following sense: one order is felicitious/has one meaning, whereas the other is infelicitous/has a different meaning. Let's call effects like the above, in which the order information is presented matters, **dynamic effects**. The questions is: how are we to square dynamic effects with the commutativity of Boolean operators?

Broadly speaking there are two ways this question can be tackled:

1. Drop the assumption that conjunction (and perhaps disjunction, see below) is commutative in its semantics.

2. Keep the semantics commutative, but introduce some principle in the pragmatics which is sensitive to order in a way that derives the desired effects.

Asymmetry in the pragmatics Discussing examples like the ones in (3), Grice 1975, opted for the second option (see Schmerling 1975 for an early dissenting view; see also Lakoff 1971 for relevant early discussion in the context of generative semantics, which argues that asymmetric 'and' is an instance of symmetric 'and'): there is no need to make the semantics of conjunction non-commutative. Instead, the fact that the two orders come with different meanings can be attributed to the **asymmetry of time**. Because language unfolds in time, which flows asymmetrically from the past to the future, comprehenders get access to information in a way that is ordered. If we assume that there is a preference for the order in which information is presented to mirror the order in which the events described by a sentence happen, then we have an explanation for the contrast in (3): in (3a) comprehenders assume that Mary got married first, because they get access to this information first; they then get access to the information that she got pregnant, and assume that this happened after the marriage, again matching the order of presentation to order of events. In (3b), because they get access to the two conjuncts in the opposite order, they assume that the events also took place in the opposite order. Therefore, a commutative semantics for conjunction, plus an assumption about how comprehenders map temporal order of presentation to order of events, gets us the desired effect.

Asymmetry in the semantics Interestingly, the kind of approach that keeps the semantics commutative has not been adopted unanimously with respect to cases like (4). An example of a different treatment occurs in the framework of Dynamic Semantics, (Heim, 1983a,b; Rothschild, 2017, among many others), where the meaning of a sentence is seen as its ability to affect the context. Suppose that we follow Stalnaker 1978, and we view a context as a set of possible worlds: the worlds that are compatible with the common assumptions of the interlocutors in a conversation. Then uttering a sentence like "John likes listening to Bach" has the effect that it removes from the context the worlds where John doesn't like listening to Bach. Therefore, the meaning of this sentence is that it removes certain worlds from the context. The process by which utterances progressively shrink the context set is known as 'update'.

When it comes to a conjunction, the assumption is that the effect of (A *and* B) on a context C is to update C by first removing the worlds that are incompatible with the first conjunct and then the worlds that are incompatible with the second conjunct: this leaves only worlds where both conjuncts are true. But note that this kind of update rules makes crucial reference to order: the left conjunct essentially updates first. Therefore, an asymmetry has been introduced **in the semantics**. The semantics of (A *and* B) is different from that of (B *and* A), as the former updates with A first and B second, whereas the latter does the reverse.

This has effects when modeling phenomena like anaphora resolution, (4), and we will see later presupposition projection. Let us for the moment focus on anaphora. In broad terms, the dynamic account of anaphora is that a pronoun like "he" comes with an index i and a requirement on this index: in the context i must be assigned to a male entity. If this condition fails, then a sentence like "He$_i$ was wearing a hat" cannot update a context C.

The contours of the dynamic approach to the contrast in (4) should already be visible: in (4a), the conjunction updates with the left conjunct first. This sets the i variable to a male entity ("a man"). Then the second conjunct updates the context; since the requirement that it comes with (that i be set to a male entity) is satisfied, everything is alright. Conversely, if in (4b) nothing has yet set i to an entity of the right kind, then when the conjunction "instructs" the first conjunct to update the context, the first conjunct finds that its requirement is not satisfied. This causes a failure of the update, and leaves the whole conjunction to be "undefined".

The question We have seen two ways to approach the issue of asymmetries that arise with respect to the interpretation of a connective like conjunction. One way is to keep the semantics of connectives symmetric and derive the asymmetry from independent pragmatic grounds, which are perhaps rooted in the asymmetry of time. This takes the core grammatical meaning of connectives to be free of order effects, with said order effects being relegated to language use. The other is to "bake" the asymmetries into the lexical entry of connectives. This drops the commutativity assumption about core meanings of connectives, locating the various order effects directly in the semantics. The question then is:

(5) **Question:** Are order effects an aspect of grammar or an aspect of use?

In this dissertation, we examine this question from the point of view of a third kind of phenomenon, one that has also featured extensively in discussions of dynamic effects: the phenomenon of presupposition and its (a-)symmetries.

1.3. (A-)symmetries in presupposition projection

1.3.1. Projection

We saw earlier that one can understand pronouns as putting a a requirement on the context in which they are uttered with respect to variable assignments. Other lexical items also put requirements on context, but not with respect to variables; rather they require that some information be already established in the context:

(6) John stopped smoking.

Uttered in a context where we have no knowledge about John's past smoking, (6) is odd (barring *accommodation* processes, on which see below for more). Instead, a felicitous utterance of this sentence requires a context where it has already been established that John used to smoke in the past. To capture this, we say that (6) presupposes that 'John used to smoke'.

A characteristic of presuppositions that sets them apart from ordinary entailments is that they are often unaffected by logical operators. The examples below involve negation, conditionalization and questioning of (6); but in all of them, what is negated/conditionalized/questioned is the entailment that 'John currently doesn't smoke', while the presupposition that he used to smoke survives:

(7) a. John didn't stop smoking.
b. If John stopped smoking, then his health must have deteriorated.
c. Did John stop smoking?

We say that the presupposition that John used to smoke **projects** from the scope of negation/question operators/conditionals, and becomes a presupposition of the whole sentence.

1.3.2. Filtering (a-)symmetries

Filtering One could imagine that whenever a subcomponent of a sentence S carries a presupposition, that presupposition projects and becomes a presupposition of S (cf. Langendoen & Savin 1971). However, as pointed out by Karttunen 1973 in some cases the presupposition projects, while in others it does not:

(8) a. # If John stopped smoking, then his health must have deteriorated.

b. ✓If John used to smoke, then he stopped smoking.

While (8a) presupposes that John used to smoke, (8b) does not; instead in (8b) the information in the antecedent that John used to smoke, somehow 'catches' the presupposition of the consequent and prevents it from becoming a presupposition of the whole sentence, or in Karttunen's more imaginative terminology, the presupposition gets 'filtered' by the information in the consequent.

Filtering is not unique to conditionals. The following examples below, involving conjunction and disjunction, have also been argued to not carry the presupposition that John used to smoke, and this can be attributed to filtering being at play (Karttunen 1973, Karttunen 1974, Stalnaker 1974, Heim 1983b a.o.):

(9) a. John used to smoke and he stopped smoking.

b. Either John didn't use to smoke or he stopped smoking.

A presupposition in the right conjunct can be filtered if entailed by the left conjunct, (9a) and a presupposition in the right disjunct can be filtered if preceded by the negation of the left disjunct, (9b).

We have thus built up to a pattern where information preceding a presupposition trigger can filter the relevant presupposition. The issue of (a-)symmetries enters the picture when we ask the following question: can we get right-to-left filtering?

(A-)symmetries Let's start with conjunction. Consider the following contrast:

(10) a. John used to smoke and he stopped smoking.

b. # John stopped smoking and he used to smoke

The traditional account of the examples in (10) goes as follows (Karttunen 1973, Stalnaker 1974 and much subsequent work): (10a) carries no presupposition that John used to smoke, whereas (10b) does (even though both entail that John used to smoke). If we are to attribute the absence of a presupposition in (10a) to filtering (for more on this qualification see the next subsection), then filtering appears asymmetric in conjunction: it happens from left-to-right, but not from right-to-left.[1]

So far then, filtering appears asymmetric. But consider the following:

(11) a. Either John didn't used to smoke or he stopped smoking.

b. Either John stopped smoking or he never used to smoke.

Both of these sentences appear felicitous, and it doesn't seem that either of them presupposes that John used to smoke (Hausser 1976, see also Karttunen 1973, 1974 for some initial suspicions that symmetry might be involved in disjunctions). If that holds, then we have an instance of

[1]Part of the argument that (10b) carries a presupposition also rests on a perceived contrast in felicity between (10a) and (10b). The idea is that since the information that John used to smoke has not been introduced in the context, if one the sentences carries a presupposition, then it will appear odd, precisely because the presupposition is not contextually established. However, as noted already by Karttunen 1973, and subsequently taken up by Schlenker 2008 and Rothschild 2011, (10b)'s infelicity might also be partially due to a violation of redundancy: the second conjunct does not offer more information than the first conjunct. This is the reason why in the end Karttunen 1973 casts the contrast between (10a) and (10b) not just in terms of felicity, but also in terms of perceived presupposition. See chapter 2 for more discussion of this issue.

symmetric filtering. Nevertheless, care is required. We have introduced filtering as a mechanism whereby presuppositions can be obviated, and are prevented from becoming presuppositions of larger structures. However, there is another mechanism that prevents the projection of presuppositions: the mechanism of accommodation.

1.3.3. Accommodation

Accommodation (Lewis, 1979) is a general pragmatic mechanism by which hearers can silently adjust their set of assumptions when they realise that that set is in conflict with the assumptions of the speaker. In the case of presupposition, accommodation comes in two guises: global and local. For example, consider the following:

(12) a. **Context:** I have no idea whether Mary has children. We meet one day and she tells me:

b. You won't believe what happened to me. Last night my son was rushed to the hospital with appendicitis!

The intuition is that (12b) sounds perfectly acceptable, despite the fact that it carries a presupposition that Mary has a son. In practice then, some presuppositions might not require that the context support them: even if I do not know that Mary has a son, it would be weird to object to Mary's informing me of her son's late night ordeal by telling her to introduce first the information that she has a son, as this was not part of our shared common ground. Instead, I can silently adjust my set of assumptions to include the information that Mary has a son, and move the conversation on from there. This kind of accommodation, where essentially the hearer adds information to the global context (the set of assumptions that me and Mary are supposed to share) is known as global accommodation.

The other, local, kind of accommodation (Heim, 1983b), is thought to be at work in an example like the following:

(13) John's cat isn't ill because John doesn't have a cat.

Despite the fact that 'John's cat' presupposes that John has a cat, the whole sentence above clearly doesn't presuppose anything like that. At the same time, this absence of a felt presupposition surely isn't due to global accommodation: the overall utterance contains the information that John doesn't have cat, so assuming the contrary would result in a contradiction. The explanation that is usually given is that (13) involves assuming the information that John has a cat locally, underneath the scope of the negation. Essentially, this boils down to saying that when we process (13), we pretend that it actually has the following logical form:

(14) It's not the case that [**John has a cat** and John's cat is ill] because John doesn't have a cat.

Therefore, filtering isn't the only reason a sentence might be perceived to lack a presupposition. Accommodation processes might also play a role. Thus, arguments to the effect that a certain operator shows symmetric filtering must make sure that any 'symmetry' effects aren't just the application of accommodation. As we will see in chapter 2, this becomes especially pressing with respect to the disjunction paradigm, repeated below:

(15) a. Either John didn't used to smoke or he stopped smoking.

b. Either John stopped smoking or he never used to smoke.

Might it be the case that (15a) shows genuine filtering, while (15b) involves local accommodation of the presupposition, essentially having a form like the one below?

(16) Either [**John used to smoke** and stopped smoking] or he never used to smoke.

Given the discussion so far, disentangling the issue of (a-)symmetric filtering seems tough on the basis of intuitive judgments alone, as one needs to be controlling for potential effects of accommodation (as well as other pragmatic factors, see chapter 2). The matter is then best settled through carefully controlled experiments, and part of the contribution of the present dissertation consists in just that.

At any rate, suppose that we do resolve the issue of filtering (a-)symmetries in one way or the other. How does this affect the debate about where (a-)symmetries belong with respect to the grammar?

1.3.4. What is at stake

As with the discussion of pronouns and temporal order of events above, the filtering problem has been approached in two ways. One approach puts the asymmetry in the pragmatics, the other in the semantics.

Asymmetry in the pragmatics This approach takes the asymmetries to result from the fact that language is processed incrementally from left-to-right. On this view the semantics of conjunction remains commutative, and some constraint applies in the pragmatics to derive the necessary asymmetries.

Simplifying a little (see chapters 2 and 3 for more details), approaches that follow this track of explanation often have the following form (see e.g. Schlenker 2008, Schlenker 2009, Rothschild 2011): an order-based pragmatic constraint applies to sentences that carry presuppositional clauses, requiring that at the moment when these clauses are encountered, comprehenders check whether the relevant presupposition obtains in the context (either because it was there to begin with, or because it was introduced by some previous part of the sentence). If so, they carry on interpreting the sentence, but if not, presupposition failure ensues.

In principle then, if we were to remove the pragmatic restriction that a presupposition be found to obtain in the context as soon as it is encountered, then we would have a fully symmetric filtering mechanism: a presupposition would be filtered if it was established in the context or introduced into the context by some part of the sentence (regardless of whether that part precedes or follows the relevant trigger). This feature of the pragmatic approach gives a potential handle on symmetries that we might observe (as e.g. with disjunction): if the pragmatic constraint is violable given perhaps a processing cost, then we might expect symmetric filtering to be available.

Finally, note the 'global' nature of this approach: the constraint applies regardless of connective: when we encounter a presupposition we want to 'resolve' it, regardless of whether it appears in a conjunction, a disjunction or some other construction. Therefore, all connectives should present the same kinds of (a-)symmetries with respect to filtering: there isn't a place for idiosyncratic behavior depending on connective. As such, while such an approach makes strong predictions, there is a question as to whether we can relax the relevant pragmatic constraint so that it predicts symmetry in some cases, but asymmetry in others (if indeed it turns out that different connectives show distinct behavior in terms of filtering (a-)symmetries).

Asymmetry in the semantics Again, one can opt for putting the (a-)symmetries in the semantics of a given connective. Taking the case of dynamic semantics, one can view presuppositions of a sentence S as putting a condition on the context, in such a way that updating the context with S is defined only if the context supports the presuppositions. Taking (A *and* B) to represent an update of a context C **first** with A, **and then** with B, then for the update to be defined the presuppositions of A need to be supported in C, and the presuppositions of B need to be supported by $C + A$ (C updated with A), much like the pronouns case we reviewed above. Note again the non-commutativity of conjunction: if B entails the presuppositions of A, but C doesn't, (A *and* B) does not denote a well-defined update, but (B *and* A) does.

Since this kind of approach resolves the issue of (a-)symmetric filtering on a connective-by-connective basis, it leaves for room for potential variation between connectives. For example, conjunction can be defined along the lines sketched in the previous paragraph, whereas disjunction can be given a more 'symmetric' outlook by having a disjunction (A *or* B) allow access to multiple ways of updating a context C: one way updates using the left disjunct first, while the other way updates with the right disjunct first. In this way, one can essentially stipulate that a conjunction exhibits asymmetric filtering, whereas a disjucntion exhibits symmetric filtering. No common behavior across connectives is forced by anything.[2]

The question that is raised in a semantic approach is one of predictiveness: while the inherent flexibility in it allows one to capture both symmetry and asymmetry, one can ask whether we can **predict rather than stipulate** which cases will show symmetry vs which will show asymmetry. Two easy responses would be to require all connectives to be symmetric, or all asymmetric (perhaps with costly access to symmetry, as in e.g. Rothschild 2011). The latter solution would make the semantic approach quite close in terms of predictions to the pragmatic approach. But the question remains whether we can have a more 'mixed' system where some connectives are systematically given symmetric updates, and others asymmetric updates (especially if it turns out that the data require it).

Interim summary Given the discussion above we can isolate the following questions as important for making progress here:

1. Is there is genuine difference of symmetry between filtering in conjunction vs filtering in disjunction? Or do both connectives exhibit parallel filtering profiles?

2. If conjunction and disjunction indeed differ in terms of their filtering profiles, is there a way of adapting either the pragmatic or the semantic approaches to the problem in a way that predicts this? And what does each approach (in its modified incarnation) have to say about the commutativity of the underlying semantics of connectives?

3. To the extent that both semantic and pragmatic theories of the phenomena are possible, can we isolate cases where their predictions differ, so as to start distinguishing them empirically?

The generality of the problem The dissertation will address each of the questions above. But before going into a summary of the responses we will provide, there is one final point to consider: namely that filtering occurs across different kinds of sentence types, and as such solutions to the

[2] As the reader who is more familiar with theories of presupposition is aware, very similar points can be made with respect to a trivalent approach to presupposition where presupposition failure is modeled as a third truth value. One can then choose either an asymmetric or a symmetric truth table for a given connective. These systems will be discussed more in chapter 3

problems of symmetric vs asymmetric filtering should apply across these different types in a **general** way.

The two relevant kinds of sentence type are declaratives and polar questions. As observed in a recent paper, (Enguehard 2021), filtering in conjunction shows the same asymmetry regardless of whether we are conjoining declaratives or polar questions:

(17) Declaratives

a. John used to smoke and he stopped smoking.

b. # John stopped smoking and he used to smoke

(18) Questions

a. Did John use to smoke and did he he stop smoking?

b. # Did John stop smoking and did he use to smoke?

As Enguehard 2021 shows (and we will see in greater detail in chapter 4), trying to apply solutions to the projection problem of the kind envisaged by Schlenker 2008 to polar question denotations quickly runs into trouble. In fact, coming up with a theory that combines theories of filtering with questions is not a straightforward task. Therefore, any kind of approach to modelling the (a-)symmetries of filtering has to contend with this, leading to the following question:

4. Given a theory of filtering, how can it be extended to apply to coordinations of polar questions?

1.4. Structure of the dissertation

We have isolated four questions that are relevant for making progress on the problem of filtering (a-)symmetries, as well as on the more general problem of interpretative (a-)symmetries in natural language. In this section, we give a sense of how each chapter of the present dissertation contributes to illuminating these four questions.

Chapter 2 This chapter represents joint work with Florian Schwarz. It attempts to meet head-on the question of whether there is a genuine difference in filtering profile between conjunction and disjunction.

To do so, it adapts the experimental paradigm of Mandelkern et al. 2020, to come up with a carefully controlled design that compares the two connectives. It concludes that there is indeed a genuine difference between the two connectives, with symmetric filtering being much more easily available for disjunction than for conjunction.

Finally, the chapter reviews the theoretical landscape in the light of this result, and concludes that any approach that predicts that all connectives should show parallel filtering behavior has trouble accounting for the data. It ends with a first shot at a theory of filtering where the underlying semantics is kept symmetric, while (a-)symmetries result from a pragmatic constraint that is inspired from the pragmatics-based theories of Phillipe Schlenker, but which uses differences in truth conditions to **predict** differences in availability of (a-)symmetric filtering.

Chapter 3 This is the core theoretical chapter of the dissertation. Three distinct systems are developed that derive asymmetric conjunction, but symmetric disjunction. Despite their differences, all of the systems deny that the asymmetric nature of some cases of filtering is to be baked into the semantics. **As such, all systems represent versions of the hypothesis that (a-)symmetry effects do not belong in core grammar.**

The first two systems are collectively known as *Limited Symmetry* and are inspired by Phillipe Schlenker's *Transparency Theory*, (Schlenker, 2007). Both of them can be viewed as pragmatic systems that leave the underlying semantics symmetric, and attempt to derive the various asymmetries by the way comprehenders interpret sentences incrementally in real time. The first system uses a fully bivalent logic, whereas the second system experiments with trivalent semantics.

The final system developed in this chapter is a version of dynamic semantics, where a constraint is stated that predicts which connectives should update the context in a preferentially asymmetric way vs which connectives show symmetry.

The three systems are compared to one another and points of divergence are identified, with the plan being to start testing these divergences in experimental research.

Chapter 4 Here the challenge of extending filtering algorithms across sentences types is taken up. Specifically, we argue that there are empirical problems involved with pursuing an approach that makes the resolution conditions of questions asymmetric in order to derives asymmetric filtering for conjunction (a version of such an approach is pursued by Enguehard 2021).

As such, we develop an extension of the bivalent *Limited Symmetry* system to the polar questions data. At a high level, our solution starts from the idea that polar questions introduce discourse referents (cf. Roelofsen & Farkas 2015), and goes on to argue that the *Limited Symmetry* algorithm should apply on this discourse referent. Our approach predicts the asymmetry of conjunctions, without leading to problematic resolution conditions. The approach also predicts symmetric filtering for disjunctions of polar questions, but we leave experimental confirmation of this prediction for the future.

Chapter 5 In this chapter the issue of distinguishing between the different theories developed in chapter 3 is taken up. The bivalent version of *Limited Symmetry* predicts that conjunctions should exhibit symmetric filtering when the first conjunct is negated. Purely asymmetric filtering is predicted when the negation is absent. On the other hand, the trivalent *Limited Symmetry* system, and the dynamic semantics system predict asymmetric filtering in both of these cases.

We present two experiments in order to clarify this issue. The first experiment offers some supporting evidence that negated conjunctions of the kind discussed above can exhibit symmetry. Unfortunately, this result is not fully conclusive due to the fact that our positive result might be attributable to local accommodation.

The second experiment aimed to control for this confound, and found that indeed local accommodation cannot be fully responsible for explaining the symmetric filtering that is present in negated conjunctions. At the same, parallel effects were found in unnegated conjunctions, which made it difficult to establish that there is indeed a difference between negated vs unnegated conjunctions.

Moreover, a different confound crept in this time (related to pragmatic effects of processing negation), making it again difficult to draw unassailable conclusions.

The chapter ends by proposing a design that will avoid further confounds, thus leaving the final resolution of the issue for the future.

Chapter 6 This chapter functions as conclusion, summarizing the main points of the dissertation, and pointing to some avenues for future research.

With this background in place and the map of the dissertation laid out, let's jump in.

Chapter 2

Presupposition projection from ‘and’ vs ‘or’: experimental data and theoretical implications

[The present chapter is joint work with Florian Schwarz. It has been accepted for publication by the *Journal of Semantics*. References to reviewer comments concern comments/suggestions made by *JoS* reviewers during the review process.]

2.1. Introduction

This chapter presents an experimental investigation of differences between conjunction and disjunction with respect to the role of linear order for presupposition projection. Projection from conjunction has been commonly (though not universally) thought to be asymmetric, such that material from the first conjunct can satisfy - and thereby ‘filter’ - a presupposition in the second conjunct, but not the other way around. Whether or not disjunction is asymmetric has been controversial in the literature. We will approach the issue of projection from disjunction through carefully controlled experiments (building on the paradigm employed for conjunctions by Mandelkern et al. 2020), which allow us to tease apart various confounding factors and possible mechanisms at play. Our results support the conclusion that disjunction and conjunction genuinely differ in terms of the role that linear order plays for projection and filtering. In particular, disjunction behaves symmetrically, allowing filtering in either direction - without any apparent cost -, whereas conjunction is genuinely asymmetric (the latter result replicates the findings by Mandelkern et al.). This pattern has substantial theoretical repercussions, as it poses a challenge to traditional dynamic semantics, and is inconsistent with accounts of projection based on general mechanisms that predict uniform effects of linear order across connectives, most prominently the Local Contexts theory by Schlenker 2009. In contrast, the data can be captured by the trivalent account of George 2008b and the recent *Limited Symmetry* account by Kalomoiros 2022a.

The chapter is organised as follows: section 2 provides theoretical and empirical background on presupposition projection. First, we review the basic projection properties of relevant connectives, as well as previously considered evidence supporting asymmetry and symmetry respectively for conjunction and disjunction. We then review two approaches to explaining symmetric projection from disjunctions in more detail: the account of Schlenker 2009, framed in his influential Local Contexts theory; and the local-accommodation-based account of Hirsch & Hackl 2014, which also builds on Schlenker's Local Contexts but offers an alternative route to account for apparent right-to-left filtering. Turning to prior experimental work, we then introduce the experimental paradigm of Mandelkern et al. 2020 in detail, which successfully tested the projection properties of conjunction, showing it to be strongly asymmetric. In section 3, we adapt the Mandelkern et al. design to test disjunction, presenting two experiments: Experiment 1 tests only disjunctions, and provides initial indications that projection from disjunction is symmetric. Experiment 2 tests minimally different conjunctions and disjunctions within a single experiment, and confirms through this more direct comparison that the two connectives indeed differ in terms of the role of linear order for projection. Section 4 looks at the theoretical implications of our results. Section 5 concludes.

2.2. Background

2.2.1. Basics of Projection

Certain lexical items are associated with presuppositions, standardly taken to require that some piece of information be established in the utterance context for their use to be felicitous (modulo global accommodation). For example, the contrast between (1) and (2) shows that (1b) is felicitous only in a context where it has been established that John has had previous research interests in Tolkien:

(1) a. **Context:** We know nothing about John's previous research interests.
b. #John continues having research interests in Tolkien.

(2) a. **Context:** We know that John has had research interests in Tolkien in the past
b. ✓John continues having research interests in Tolkien.

A key characteristic of presuppositions is that they can escape from the scope of various embedding operators, like negation, questions and conditionals (the so-called 'family of sentences' test, Chierchia & McConnell-Ginet 1990):

(3) a. **Context:** We know nothing about John's previous research interests.
b. #John does not continue having research interests in Tolkien.
c. #Does John continue having research interests in Tolkien?
d. #If John continues having research interests in Tolkien, then he will be able to help us.

While the assertive component is affected by these embeddings (for instance (3b) no longer entails that John currently has research interests in Tolkien), the presupposition that John has had previous research interests in Tolkien remains, just like in(1b): the presupposition **projects**. Importantly, presuppositions don't always project, even from one and the same embedding. Consider the following contrast in conjunctions:

(4) a. #John continues having research interests in Tolkien and he had prior research interests in Tolkien.
b. John had prior research interests in Tolkien and he continues having research interests in Tolkien.

When the first conjunct introduces the presupposition, (4b), the sentence as a whole seems felicitous without a supporting (extra-sentential) discourse context, in contrast to (1b), suggesting that the sentence as a whole does not carry the presupposition introduced by *continue*. However, when the first conjunct contains the presupposition trigger and the second conjunct introduces the information supporting the presupposition, as in (4a), infelicity ensues.[3] Data like this give rise to the **projection problem**, which asks for an algorithm predicting exactly when a complex sentence will

[3]The empirical picture may be more nuanced due to other factors at play, but we will not get into this here; see Mandelkern et al. 2020, reviewed below, for detailed discussion and experimental data addressing potential issues and confounds.

end up inheriting a presupposition of its parts (as in (4a)), and when it will not (as in (4b)).

An influential early approach to this problem for conjunction is due to Stalnaker: As a hearer encounters (4b), they first parse the first conjunct and the following ‘and’. At this point, they can already add the information that John had prior research interests in Tolkien to the global context represented by the common ground (construed as the set of worlds compatible with what is mutually assumed by the discourse participants). As they go on to parse the second conjunct, they thus can evaluate its presupposition relative to an updated context already including that information, meaning the presupposition is supported and its use felicitous. Thus, (4b) comes with no relevant constraints on the contexts - the presupposition in the second conjunct gets ‘filtered’, in the terminology of Karttunen 1973. In contrast, in (4a), the first conjunct gets evaluated against the global context, so it is infelicitous unless that context entails that John had prior research interests in Tolkien. The second conjunct, which supports the presupposition, seems to ‘come too late’ to make a difference.

Note that the context relative to which a presupposition in a complex sentence is evaluated can include information introduced by other parts of the same overall sentence. This is the ‘local context’ (Karttunen, 1974, and much subsequent work). The question of how to precisely and systematically define what counts as the local context in a given embedded environment is at the heart of theoretical accounts of presupposition projection, and we’ll turn to some detailed proposals shortly. However, taking for granted for the moment an intuitive characterisation of ‘local context’ as sketched above, the standard generalization about presupposition projection can be stated as follows:

(5) A presupposition must be satisfied in its local context.

In (4a), the local context is simply the global context, so the constraints the presupposition trigger places on its local context are automatically constraints on the global context as well. However, in (4b) the local context is the initial global context plus the information contained in the first conjunct.

As the contrast between (4a) and (4b) shows, not all 'other parts of the same complex sentence' seem to count equally in terms of contributing to the local context for a given presupposition. Indeed, settling which other parts of complex sentences can do this in various embedding environments is the core challenge in coming up with a precise and empirically adequate definition of the notion of local contexts. The sketch of an account of presupposition projection from conjunction, originally proposed by Stalnaker, crucially depends on the idea that the time-course of information becoming available - reflected in the linear order in written form - has a central role to play: as parts of a sentence get parsed bit by bit, information becomes available to the listener and can be added to the common ground (where appropriate). Thus, the resulting notion of local contexts is inherently an asymmetric one: earlier conjuncts form part of the local context for later conjuncts, but not the other way around. From this perspective, presupposition filtering in conjunction is asymmetric, in that left-to-right filtering of presuppositions is possible, whereas right-to-left filtering is not. A key theoretical question is to what extent this property generalizes to other connectives. The beginnings of an answer emerge when we look at connectives other than conjunction.

Consider the disjunction in (6b), where the presupposition in the second disjunct is filtered if **the negation of the first disjunct entails the presupposition**. No infelicity arises, even in a context where the presupposition is not previously supported:

(6) a. **Context:** We know nothing about John's previous research interests.
    b. Either John has never had research interests in Tolkien or he continues having research interests in Tolkien.

Contrary to conjunction however, switching the order of the disjuncts does not seem to affect the felicity of the sentence. Intuitively, (7) is not felt to presuppose that John used to have research interests in Tolkien, either. (This was first observed in Partee's so-called 'bathroom sentences'.[4])

[4] The original 'bathroom sentences' are disjunctions like the following, hence the name:

(i) Either the bathroom is in a weird place or this house has no bathroom.

(7) Either John continues to have research interests in Tolkien or he never had such interests.

Setting aside possible alternative explanations of this fact (which we'll consider below), seeing this as a case of right-to-left filtering raises the question of why the role of linear order for projection differs across conjunction and disjunction, such that presuppositions in a first conjunct cannot be filtered by information in the second conjunct, while disjunction does allow filtering in a parallel configuration. However, before turning to that important theoretical question, it is very much worthwhile assessing the empirical picture more carefully, as the data are not always clear-cut and there could be confounds contributing to the observed patterns. Furthermore, alternative theoretical perspectives may derive (parts of) this pattern through mechanisms other than filtering. Thus, the main focus of the present chapter is empirical, namely to experimentally explore the apparent contrast, and where possible to tease apart the candidate theoretical mechanisms that underlie it. We then turn to a brief assessment of theoretical options in light of our findings at the end.

Before diving into the experimental approach, we first need to introduce more details of the most relevant previous accounts of presupposition projection and the different ways they handle (a-)symmetry effects in projection. The first account is the Local Context account of Schlenker 2009, which makes room for both asymmetric and symmetric interpretations across connectives based on processing considerations. The second account is that of Hirsch & Hackl 2014, which builds on the Local Context approach but also brings into play the mechanism of 'local accommodation' (introduced below) to account for apparent cases of symmetric filtering in disjunction.

2.2.2. Symmetry and Asymmetry with Disjunction

2.2.2.1. Schlenker 2009

The general question of what counts as a local context in various embedding environments comes with a key architectural choice point for theories of presupposition projection: given a connective that forms complex sentences, is the specification of the local context for a sub-part of the complex sentence encoded in the lexical entry of the connective? (E.g., effectively specifying 'the presupposition of the second conjunct in a conjunction is evaluated in a context that contains the information of the first conjunct' in the lexical entry of *and*.) Or is there a general mechanism that applies uniformly across sentences with connectives to derive the local contexts of their parts?

Broadly speaking, these options are associated with the labels of semantic vs. pragmatic approaches to projection. The influential early work by Stalnaker mapped out a path along the latter route; but motivated at least in part by certain shortcomings in coverage (e.g., with regards to projection from quantifiers), the context change semantics of Heim 1983b put forward a semantic approach that was more powerful. This, in turn, faced criticism for lacking explanatory adequacy, as the overall system required a stipulative choice between different options for lexical entries for connectives such as *and* (see section 4 for more details). More recently, Philippe Schlenker's work (Schlenker, 2009) ventures to preserve the coverage of Heimian dynamic semantics in a pragmatic reconstruction of Local Contexts within a classical semantics, which ensures explanatory adequacy.

Following the standard Stalnakerian tradition, we will be thinking of contexts as sets of possible worlds compatible with what the interlocutors take to be the case for purposes of conversation. At the core of Schlenker's proposal is the idea that in determining what counts as a local context, there's an underlying strategy of efficiency: presuppositions are only evaluated relative to those possible worlds that are not ruled out by the already present parts of the complex sentence.

Schlenker assumes a simple propositional language with a classical bivalent semantics. The notation $C \models p$ means that the proposition expressed by p is True in every world in C. Based on the general idea above, he defines both asymmetric and symmetric variants of local contexts. Here's the definition for the asymmetric local context of an expression E (adapting the formulation of Mandelkern & Romoli 2017 for simplicity; see Schlenker 2009 for full details):

Definition 1 Asymmetric Local Context: The asymmetric local context of a sentence E in a syntactic environment a _ b and global context C is the strongest proposition r such that for all sentences D and good finals b', $C \models a(r\ and\ D)b' \leftrightarrow a(D)b'$.

The idea is to not bother considering worlds already excluded by a when evaluating E. Thus, the

Local Context r represents the smallest subset of C that one can restrict attention to after having sorted out C-worlds based on the information contained in a.

In this light, consider a conjunction (**p and q**): to calculate the local context for q in a global context C, we need to calculate the strongest proposition r such that for all sentences D and good finals b', $C \models$ (**p and** (**r and D**)**b**$'$ $\leftrightarrow$ (**p and** (**D**)**b**$'$. There is only one possible good final in this case, a closing parenthesis, ')'. We have two grounds for excluding worlds from further consideration: those that are not in the context C from the start, and those in which p is false. Thus, ${}^{c}p$ (p considered relative to C, which is just the intersection of the two) is the Local Context for q. ${}^{c}p$ indeed is the strongest proposition r we can consider in line with the definition. To see this, suppose that there is a proposition r that excludes a C-world w' that satisfies p: so p is True in w', but r is False in w'. Suppose also that D is true in w'. In this case, (**p and D**) is True in w', but (**p and** (**r and D**)) is False; but that means that it no longer holds that for all D, $C \models$ (**p and D**) $\leftrightarrow$ (**p and** (**r and D**)). Any such restriction will be too strong, and r cannot be stronger than ${}^{c}p$.

Thus, the local context for a second conjunct is the first conjunct (relativized to C). With regards to presupposition projection and filtering, this means that if the first conjunct, considered in C, entails the presuppositions of the second conjunct, then the presuppositions of the second conjunct will be satisfied in its local context, respecting the constraint in (5). Applying parallel reasoning to the first conjunct, it can easily be shown that its local context is C itself, as failing to consider any C-world could lead to failure of the contextual equivalence in Definition 1. Thus, projection from conjunction is modeled as asymmetric: p (relativized to C) matters for evaluating the presuppositions of q, but not the other way around.

Let us now turn to consider what Schlenker's definition of local context yields for disjunctions, starting with the second disjunct. Take (**p or q**): From left-to-right, p gets parsed, and then '*or*'. A disjunction is true iff at least one of the disjuncts is true. Therefore, if p is true, then the entire disjunction is bound to be true, regardless of the second disjunct. The second disjunct only winds up mattering for the overall truth value in C-worlds where p is false. Thus, the local context in which q is evaluated is the set of C-worlds where p is false. This predicts that a presupposition in q will be filtered iff it is entailed by the negation of p as considered in C. This correctly captures the standardly observed projection behavior, (6b).

Turning to the local context of the initial disjunct, the asymmetric perspective laid out above applies in a manner entirely parallel to the case of an initial conjunct: Failing to consider any C-world in evaluating p risks breaking the equivalence required by Definition 1: it allows for C-worlds where the hypothetical strengthened restriction r is false even though either p or q (and possibly both) are true. Thus, just like in the case of conjunction, disjunction is asymmetric, in that the initial disjunct p is crucial for the calculation of the local context for the second disjunct q, but not vice versa. However, as discussed in the previous section, this prediction is challenged by (7).

A theory based on Definition 1 above leaves open a limited number of options to account for this observation: first, it can make the notion of local context more flexible to make room for filtering in this case; second, it can deny that the intuitive acceptability of (7) is due to presupposition filtering by invoking another relevant mechanism. Schlenker chooses the first route (the second will be considered separately below), by defining an additional symmetric version of local contexts, where information that appears to the right of the expression whose local context is being calculated *can* be taken into account:

Definition 2 Symmetric Local Context: The symmetric local context of a sentence E in a syntactic environment $a\ \_\ b$ and global context C is the strongest proposition r such that for all sentences D, $C \models a(r\ and\ D)b \leftrightarrow a(D)b$.

By virtue of directly including the actual completion b here and no longer quantifiying over all possible completions b', this b is now available when considering the required contextual equivalence: the smallest subset of C one can restrict attention to in this case is based on what is contained in a and b. The symmetric local context of p in (**p or q**) – where the parenthesis (corresponds to a, **p** corresponds to _, and **or q**) corresponds to b – thus will not include C-worlds where q holds, as their fate is already determined by the actual completion: just looking at not-q worlds in C suffices. Thus the symmetric local context of p here is made up of C-worlds where it is not the case that q. This symmetric definition is required if one wants to account for the felicity of (7) in terms of right-to-left filtering.

While the introduction of symmetric local contexts accounts for the felicty of (7), it also immediately raises the question of how the two definitions of local contexts relate to one another. If symmetric local contexts were freely available across the board, one might as well do away with any asymmetric notion, as any constraints that it specifically would impose could always be undone by appealing to the symmetric version. Maintaining that projection is fundamentally rooted in the incremental nature of parsing, Schlenker argues the asymmetric definition of local context to be the default. Correspondingly he posits the symmetric version to be associated with additional processing cost, due to its non-incremental nature that requires postponing presupposition evaluation to when the relevant full complex structure (e.g., a full disjunction) has unfolded.

Having both asymmetric and symmetric variants of local contexts available, though with a cost in the case of the latter, does seem to make room for accounting for the projection data for both conjunction and disjunction. But this approach makes several further key predictions: First, there should be measurable reflexes of the processing costs posited for the use of symmetric local contexts; in other words, (7) should be harder to process than (6b).

Second the relative availability and any potential processing costs associated with the use of the two types of local contexts should be uniformly present across connectives. In other words, if it's possible to appeal to the symmetric local context for disjunction in (7), then the same should go for conjunction in (4a), i.e., the latter, too, should allow for right-to-left filtering, invoking the same amount of processing cost as in the parallel disjunctive case. And indeed, various authors have argued for a reconsideration of the empirical status of sentences like (4a) in the theoretical literature (cf. Rothschild 2011). However, recent experimental work by Mandelkern et al. 2020, discussed in detail below, has argued that right-to-left filtering is categorically unavailable for presuppositions in conjunctions, and this work forms the starting point for our experimental investigation of disjunction. But before turning to the empirical side, we need to consider the second option for dealing with the felicity of (7) in a theory based on asymmetric local contexts.

2.2.2.2. Hirsch & Hackl 2014

Hirsch & Hackl 2014 pursue an alternative response to the challenge posed by bathroom disjunctions, which makes it possible to maintain a genuinely asymmetric filtering mechanism. Rather than explaining the presuppositional acceptability of (7) in terms of right-to-left filtering via symmetric local contexts, they derive it via local accommodation (see below). Assuming strictly incremental parsing that allows only for left-to-right filtering, they take presuppositions in the first disjunct to project in an initial step. However, this interpretation is subsequently discarded due to violation of a general pragmatic constraint, which triggers the application of local accommodation.[5] The relevant pragmatic principle they invoke is the 'Non-Opinionatedness' constraint (NO), which states that for a disjunction 'S_1 or S_2' to be felicitous the speaker must believe that both disjuncts are live options in the discourse. Consider (8):

(8) Either Sue went to the cinema or she went to the department store.

According to NO, this disjunction is infelicitous in contexts where we know that Sue went to the cinema and did not go to the department store (or the other way around). Both disjuncts must be possible outcomes. This follows from the maxim of quantity (Grice 1975): if the speaker knows that only 'Sue went to the cinema' is true, then they should just assert that, similarly for 'Sue went to the department store'. Let us now consider the impact of NO on bathroom disjunctions:

(9) Either John continues having research interests in Tolkien or he has never had research interests in Tolkien before.

As the sentence is incrementally parsed, the presupposition of the first disjunct projects in an

[5] A version of this account can also be found in Schlenker 2008.

initial step, placing the standard requirement on the global context that John used to have research interests in Tolkien. However, maintaining such a global requirement would amount to committing to the second disjunct being false in the context (as it explicitly denies that John used to have research interests), thus violating NO. As soon as this violation is detected, the hearer attempts to remedy this violation, and resorts to an operation of local accommodation, which provides an alternative means for preventing the presupposition from projecting.

A few comments about the notion of accommodation just invoked: Accommodation is a general context-updating mechanism that hearers utilize in order to silently adjust the context when they realize that their common ground and that of their interlocutor diverge (Lewis, 1979). It comes in two varieties: global accommodation, where information is added to the global common ground, and local accommodation (Heim, 1983b). The focus for our purposes is the latter type, which is invoked in cases where a presupposition cannot be added to the global context for some reason, e.g., because that would lead to an inconsistency. To illustrate:

(10) There is no King of France. Therefore, the King of France is not bald.

Even though definite descriptions such as *the King of France* typically are associated with an existence presupposition, (10) does not seem to presuppose that there is a king of France, nor does it suffer from presupposition failure of any sort. The absence of the presupposition that 'there is a king of France' cannot be due to global accommodation, given that there is no corresponding global inference. However, local accommodation has the effect of adding the information introduced by the presupposition trigger locally in the scope of the operator, meaning that it will behave just like asserted content in terms of being affected by it. Thus, the presupposition will not end up affecting the global context directly, i.e., not project. While there are different specific implementations of the particular mechanism (e.g. Heim, 1983b; Beaver & Krahmer, 2001), this level of detail suffices for our purposes. By providing an alternative way to avoid projection, local accommodation comes to the rescue in bathroom disjunctions with apparent right-to-left filtering, as it helps to avoid the clash with NO that would arise if the presupposition were interpreted globally; effectively, it results in an interpretation that can be paraphrased as follows:

(11) Either John **used to have research interests in Tolkien** and continues having research interests in Tolkien, or he has never had research interests in Tolkien.

Importantly, local accommodation is commonly taken to be a dispreferred option, and is accordingly assumed to be associated with a processing cost by Hirsch & Hackl (first experimental data supporting this assumption was presented in Chemla & Bott, 2013; Romoli & Schwarz, 2015). Accordingly, their account of bathroom sentences posits an asymmetry based on disjunct order in bathroom sentences, as only the left-to-right variant involves filtering, whereas the reverse order requires local accommodation to avoid the clash with NO, and as such comes with a cost comparable to that found for local accommodation in other contexts. This, in turn, puts it on par with the proposal by Schlenker with regards to disjunction, which posits additional processing costs for symmetric filtering.[6]

2.2.3. Experimental Background: Asymmetry in Conjunction

To investigate the (a)-symmetry of disjunction experimentally, we build on the methodological approach of Experiment 3 in Mandelkern et al. 2020, who investigate (a-)symmetry in conjunction. They use an acceptability task, where participants are presented with a sentence in a context, and have to evaluate how natural the sentence sounds in the given context on a 7-point scale. The point of the Mandelkern et al. experiment was to investigate whether or not right-to-left filtering is available in conjunctions (as is arguably predicted by a uniform projection mechanism that is asymmetric by default, but symmetric underlyingly, such as Schlenker's).[7] The key target sentences are illustrated

[6]Note that Hirsch & Hackl 2014 report experimental data from binary forced choice preference tasks that indeed suggest that bathroom disjunctions with the trigger in the second disjunct are preferred. We do not review these details here, but see some brief comments in footnote 15.

[7]Experiments 1 & 2 of that work use an inferential task, where participants have to indicate whether the content of the presupposition is contributed at the global level or not. An anonymous reviewer raises concerns about the acceptability task as, at a minimum, not adding anything to the inferential results, as presuppositions in initial conjuncts could give rise to lower acceptability even if a symmetric interpretation in principle is available, due to the other conjunct-ordering choice being preferred. However, we note that the inference task results from Mandelkern et al. gave rise to other issues with surprising asymmetries and apparent projection effects in non-presuppositional controls.

using the the emotive factive trigger *happy* (which presupposes its complement clause to be true):

(12) a. **Context:** Jacob has been traveling a lot, but I'm not sure where he is this week:

b. Ps-First (A conjunction with a presuppositional first conjunct and a second conjunct that entailed the presupposition of the first conjunct):
If Emily is happy that Jacob is in France and he is in Paris, then she will call him soon.

c. Ps-Second (A conjunction with a presuppositional second conjunct, and a first conjunct that entailed the preuspposition of the first conjunct):
If Jacob is in Paris and Emily is happy that he is in France, then she will call him soon.

The central questions were a) whether, and to what extent, the order of conjuncts affects acceptability, and b) whether the potential presuppositional support in the second conjunct helps with presuppositional acceptability at all. Two things to note: **(i)** the conjunctions containing the presupposition trigger are embedded in the antecedent of a conditional and presented in an Explicit Ignorance context. This complexity is necessary: an unembedded version of the PsFirst sentences without any context could be acceptable either because of right-to-left filtering, or because of global accommodation. Embedding the conjunction in the antecedent of a conditional (an environment from which presuppositions standardly project), and placing the conditional in a context like (12) which denies knowledge of Jacob's whereabouts, differentiates between these: A globally accommodated presupposition would project, and thus contribute globally, coming into conflict with the context in (12). In contrast, if the presupposition were filtered (right-to-left) by the following conjunct, it should not have any impact on the global context (no conflict in this case). **(ii)** the presupposition-bearing conjunct asymmetrically entails the presupposition-less conjunct, to avoid a potential confound of redundancy (Rothschild, 2011).[8]

Furthermore, the acceptability data reported there show presuppositions in first conjuncts to be as unacceptable as controls without a conjunction that don't allow any filtering option. Finally, our main focus in the present work is on comparing conjunction and disjunction, and since the reviewer's concern would seem to apply equally to both connectives, it will not undermine the interpretation of any differences in (a-)symmetry between them.

[8]As we depart from this in our Experiment 1 due to the properties of disjunction, we do not dwell on this feature here. Its motivation stems from the need to control for any potential redundancy-induced infelicities, as 'Mary is happy that Jacob is in France and Jacob is in France' could be infelicitous not because of anything related to

In order to measure the differential acceptability based on the interpretive options for the sentence in question, target sentences were preceded by two different types of contexts: an explicit ignorance context (EI, Simons 2001; Abusch 2010), which explicitly asserts that the presupposed proposition was not settled in the context; and a support context (S), which explicitly supported the presupposition.

(13) a. **Explicit Ignorance:**

Jacob has been traveling a lot, but I'm not sure where he is this week.

b. **Support**:

Jacob has been traveling a lot, and he's in France this week.

If a global accommodation interpretation of **PsFirst** were adopted, then the sentence should be unacceptable in the Explicit Ignorance context, because the speaker first explicitly states that they do not know whether p, and then goes on to globally presuppose that p in the following sentence. The **Support** context, where no such issue arises, serves as a control. In contrast, if an interpretation using right-to-left filtering were adopted, **PsFirst** should be acceptable in either context, since there would be no global inference in that case. Ps-Second provides a baseline of the acceptability of the overall conjunction in a case where no projection is predicted to take place (due to universally assumed left-to-right filtering; also see non-presuppositional controls serving the same purpose below). If right-to-left and left-to-right filtering were equally available, these should be on par in terms of acceptability. If the former is more difficult to access, then **PsFirst** would be expected to be somewhat less acceptable. In order to assess just how acceptable it might be in such a case, a necessary point of comparison is provided by a control condition that lacks the second conjunct:

(14) SimplePs (A simple presuppositional sentence):

projection, but because the second conjunct simply reiterates information that was already added to the common ground via accommodation of the presupposition of the first conjunct. Having the asymmetric entailment avoids this confound and we adopt this move in our conjunction stimuli in Experiment 2.

If Emily is happy that Jacob is in France, then she will call him soon.

If right-to-left filtering is an option at all, PsFirst should be more acceptable than SimplePs based on that. SimplePs also controls for potential (presumably limited and/or costly) availability of local accommodation inside the *if*-clause, as this is the only remedy for making this sentence acceptable in the Explicit Ignorance context (and this should be equally available in PsFirst).

Furthermore, to control for the general acceptability of conjunctions embedded in the antecedent of a conditional, as well as potential conjunct-order effects independent of the key presuppositional properties, non-presuppositional controls corresponding to either conjunct order were included as well:

(15) a. NoPsFirst (A conjunction like the one in PsFirst, but with no presupposition in the first conjunct):
If Emily was hoping that Jacob is in France and he is in Paris, then she will call him soon.

b. NoPsSecond (A conjunction like the one in PsSecond, but with no presupposition in the second conjunct):
If Jacob is in Paris and Emily was hoping that he is in France, then she will call him soon.

Across the board, the support context provides a baseline point of comparison for the acceptability of the target sentences in the absence of presupposition-related infelicities.

The results of Mandelkern et al. 2020 strongly support an asymmetric view of projection from conjunction. As can be seen in Figure 1, a PsFirst sentence is less acceptable than PsSecond in an EI context. There is no significant order effect in the non-presuppositional control conjunctions, but a strong order effect in the presuppositional case (giving rise to a significant statistical interaction). This suggests that the main source of the unacceptability of PsFirst is the relative unavailability of right-to-left filtering, leading to a global presence of the presupposed information (for full details, see Mandelkern et al., 2020).

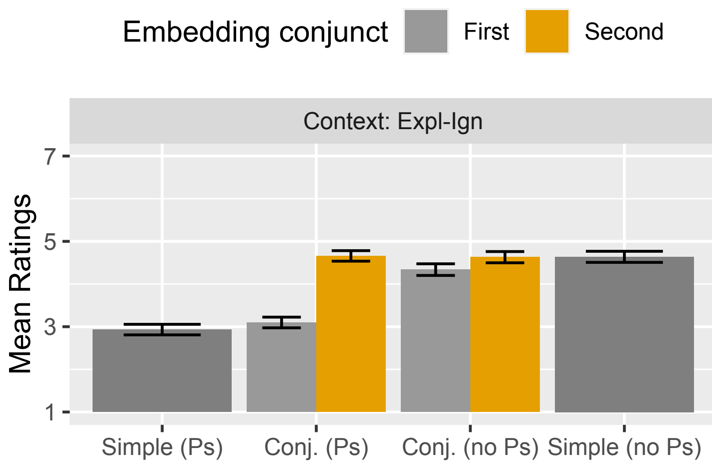

Figure 2.1: Mean acceptability for each condition in Mandelkern et al. 2020

Note that the use of Explicit Ignorance contexts is directly designed to bring out whatever availability of right-to-left filtering there might be. Since it's the only rescue for making the discourse as a whole felicitous (barring local accommodation, which is independently controlled for), comprehenders would be expected to resort to it, even if it comes at a cost. But note that the acceptability of the PsFirst sentences in EI contexts is just as low as that of the SimplePs sentences, where the only mechanism for rescuing acceptability in an EI context is local accommodation. Thus, the fact that the acceptability of PsFirst sentences parallels that of SimplePs sentences in EI contexts is evidence that right-to-left filtering is not available at all in PsFirst sentences, and that the extent to which they are acceptable is entirely attributable to the availability of local accommodation.

In sum, Mandelkern et al. 2020 present a strong case for filtering in conjunction to be asymmetric, and rigidly so, not just as a processing preference or default. In light of the success of this paradigm for testing projection (a-)symmetries in conjunction, we adapt this approach in order to answer the corresponding question for disjunction: Do disjunctions allow right-to-left filtering of presuppositions?

2.3. Experiments on (a-)symmetry in Disjunction

2.3.1. Experiment 1: Symmetry in Disjunction

2.3.1.1. Design

Our first experiment aimed at testing the (a-)symmetry of projection in disjunction. While our design adapts the general approach of Mandelkern et al. 2020, we also diverged in some important details, largely due to implementation challenges specific to looking at disjunction.[9] We present examples of our stimuli first, and then comment on the motivations for the various differences. We created 6 items using different triggers (*continue*, *again*, *aware*, *find out*, *happy*, *stop*), with variations in 6 conditions (in the examples below, the presupposition-bearing disjunct is underlined for presentational purposes only).

Our disjunction target sentences in the PsFirst vs. PsSecond conditions are instances of 'bathroom disjunctions', as illustrated in (16)-(17): If any filtering asymmetries are present in disjunction, they should show up as differences in the acceptability between these two conditions (we turn to detailed discussion of predictions of the various accounts in the following section):[10,11]

[9] Note that experiment 2 manages to mirror the Mandelkern et al. design more closely.

[10] Note that our bathroom disjunctions utilize the 'Either…or' configuration. As pointed out by an anonymous reviewer, if one were to take 'Either…or' to be *exclusive*, then this would result in a disjunction where the local context for both the first and the second disjunct would be the global context; as such, presuppositions would project equally from both disjuncts (see also Mayr & Romoli (2016); see section 4.1 for discussion and arguments against this possibility in light of our data). Consequently, taking (as we do) PsSecond disjunctions in our stimuli to allow (at a minimum, left-to-right) filtering, we are making the following two assumptions: i) 'Either…or' disjunctions are semantically inclusive; ii) Whatever implicature-calculation mechanism produces exclusive readings is not relevant for the purposes of presupposition calculation. As pointed out by our editor, Yasu Sudo, as well as by an anonymous reviewer, the second assumption comes with interesting complexities. To the extent that our disjunctions are interpreted exclusively there is a question where this exclusivity comes from. If it comes from an *Exh* operator, then assumption (ii) might be problematic, since Local Contexts predicts projection from both disjuncts in that case, Mayr & Romoli (2016). However, there is another potential source for the exclusivity of our disjunctions: both disjuncts cannot be true simultaneously, since in bathroom disjunctions the non-presuppositional disjunct denies the presupposition of the other disjunct. For example, in (16) below, the truth of *John continues having research interests in Tolkien* makes the sentence *John has never had an interest in Tolkien and the book is unrelated to his research* false; conversely, the truth of *John has never had an interest in Tolkien and the book is unrelated to his research* makes *John continues having research interests in Tolkien* false or undefined (depending on what we take the semantic contribution of presupposition to be). Given this complex picture, we keep to our assumption (ii) for the purposes of the current paper, and defer further exploration of the interaction between presupposition and implicature calculation in disjunctions to future research.

[11] Another note on using disjunctions with an initial 'Either…or': we chose to focus on this in our experiments as it is the classic form in which bathroom disjunctions have appeared in the projection literature. At the same time, (as pointed out by an anonymous reviewer), this constitutes another difference to the conjunctions from Mandelkern et al. (and the ones in our Experiment 2 below), and gives rise to the question whether parallel results would be

(16) Either John continues having research interests in Tolkien, or he has never had an interest in Tolkien and the book is unrelated to his research. (PsFirst)

(17) Either John has never had an interest in Tolkien and the the book is unrelated to his research, or he continues having research interests in Tolkien. (PsSecond)

Note that in order to increase overall discourse coherence and felicity, our non-presuppositional disjunct was expanded to include a conjunction (e.g., *and the book is unrelated to his research*), which intuitively helped in situating the possibility presented in that disjunct.[12] These disjunctions were presented in Explicit Ignorance contexts, to measure potential impact of a globally projected interpretation of the presupposition on acceptability, as in the Mandelkern et al. design.

(18) **Context:** My friend John researches 20th century literature. One day, I stopped by his house and I saw a copy of Tolkien's "The Fellowship of the Ring" lying around.

a. I *don't know if John has ever had research interests in Tolkien's work*, so I thought: (EI)

Again following Mandelkern et al., we included non-presuppositional disjunction variants (NoPs), (19)-(20) to control for potential order effects on acceptability that are orthogonal to presup-

obtained in the case where 'either' was omitted. It is clear that without 'either', comprehenders do not know that they are dealing with a disjunction until later when they encounter 'or'. We don't see a strong intuitive case for symmetry in disjunction hinging on the presence of 'either', but have to leave more systematic investigation of this question for future research.

[12]On a purely formal level, this may give rise to a worry about filtering: the negation of the non-presuppositional disjunct of the form $q\&r$ is logically weaker than the negation of just q, which is the part that would ensure filtering. However, the actual conjunctions all had the added conjunct constructed so as to basically render it as a consequence of the first conjunct (e.g., the book being unrelated to John's research is something that would follow from him never having had a research interest in Tolkien), making it extremely unlikely that one would consider the problematic case where q was true but r was false. Therefore, we think based on contextual entailment, which is usually taken to be what's relevant for presupposition evaluation, filtering is available as intended here. Empirical support for this take comes from the finding below that the presuppositional disjunctions are on par with their non-presuppositional controls. Furthermore, Experiment 2 below does not utilize this configuration, but renders results that are parallel in the relevant ways.

position projection. These controls were also presented in the Explicit Ignorance context.

(19) Either John has research interests in Tolkien, or he has never had an interest in Tolkien and the book is unrelated to his research. (No-Ps-First)

(20) Either John has never had an interest in Tolkien and the the book is unrelated to his research, or he has research interests in Tolkien. (No-Ps-Second)

The design thus employed the two-level factors Order (First vs Second) and PsType (Ps vs No-Ps). Presupposition-related order effects in the Ps conditions, above and beyond any such potential effects in No-Ps control conditions, would be reflected in an interaction between these.

A final set of controls was provided by conditionals with simple (non-coordinated) antecedents containing a presupposition (SimplePs), (21):

(21) If John <u>continues having research interests in Tolkien</u>, then that's why he is reading 'The Fellowship'. (SimplePs)

These were presented both in Explicit Ignorance (EI) contexts, (18), and also in Support (S) contexts, (22), where the presupposition was already globally established. The difference in the acceptability of SimplePs sentences in EI vs S contexts provides a baseline for the availability of local accommodation, since SimplePs is available in EI contexts only to the extent that local accmmodation is available (again as in Mandelkern et al.).

(22) **Context:** My friend John researches 20th century literature. One day, I stopped by his house and I saw a copy of Tolkien's "The Fellowship of the Ring" lying around.

a. I *know that John has been researching Tolkien* recently, so I thought:... (S)

While the core of our design parallels that of Mandelkern et al. 2020, there are several substantial differences in both item construction and overall setup:

(23) a. No embedding in *if*-clause

b. Fewer items (but more participants)

c. No asymmetric entailment in the support-clause

d. No Support contexts (except for SimplePs control)

e. No fillers

Starting with (a), our target disjunctions in the (No-)PsFirst/Second conditions were not embedded in the antecedent of a conditional: we found that sentences following that pattern both were difficult to construct and quickly get very complex and hard to evaluate (although see Experiment 2 below, where we managed to create more digestible stimuli of this type). But conceptually, the motivation for embedding conjunctions in conditionals also doesn't extend to disjunctions, thus making this complication unnecessary: as noted above, for an unembedded conjunction, you cannot easily differentiate whether a presupposition introduced in the first conjunct might be acceptable because it can be globally accommodated, or because it has been filtered; the information will enter the updated context either way. The same does not hold for disjunctions, due to their different truth conditions: regardless of what mechanism one holds responsible for preventing projection, presuppositions in bathroom disjunctions do NOT become part of the updated context (e.g., the sentence in (6b) leaves open whether or not John has had prior research interests in Tolkien).

Turning to (b), even for the simplified stimuli without embedding in a conditional, bathroom disjunctions are a very particular type of sentence, and it is not easy to construct sentences and contexts that are readily comprehensible and reasonably acceptable. In addition, sentences of this sort can run the risk of participants becoming sensitive to their particular nature and adopting task-specific strategies. We therefore opted here to use a much smaller set of stimuli, and to make up for the corresponding loss in statistical power by having a greater number of participants instead.

(Note that the approach in Experiment 2 in a sense balances out the relevant trade-offs here, as a more standard size set of stimuli is used.)

The third difference from Mandelkern et al. 2020, (c), in our design concerns the relationship between the other disjunct and the presuppositional one: in the conjunction stimuli used by Mandelkern et al., the other conjunct asymmetrically entailed the presupposition of the presuppositional conjunct (to avoid potential confounds of redundancy; see footnote 5). Neither the problem (of redundancy) nor the solution transfer directly to disjunctions, and therefore, the negation of the other disjuncts in our stimuli is equivalent to the presupposition in the presuppositional disjunct (rather than asymmetrically entailing it).

The fourth difference, (d), is that we only used the SUPPORT context with SIMPLEPS, as it is infelicitous to assert a bathroom disjunction in a context that explicitly supports the presupposition:

(24) (Uttered in a context where we know that the house has a bathroom)
Either the bathroom is in a weird place or this house has no bathroom!

This infelicity is attributable to a general constraint in disjunctions, captured, e.g., by the Non-Opinionatedness constraint of Hirsch & Hackl (2014, discussed above): The disjunct that expresses the non-existence of the bathroom cannot be a live option if the context already establishes that there is a bathroom. Not too much is lost by this move, however, as the sole role of the SUPPORT context is to provide a baseline for what happens when no clashes due to presupposition projection arise: in the SUPPORT context, this is achieved by having the presupposition be entailed by the global context. But the NOPSFIRST and NOPSSECOND effectively serve the same general purpose, as they do not introduce any presupposition in the disjunction at all, and as a consequence, these items themselves also do not gain anything from being presented in a Support context.

The final difference, (e), between our design and that of Mandelkern et al. 2020 is that we did not include filler items. This decision was closely related to our choice to only present 6 items to participants, each in a different condition. One of the main reasons to include fillers generally is to distract from experimental items. As we only presented a very small number of items, we decided that they were not necessary, and instead prioritized keeping the length of the experiment as a whole minimal.

2.3.1.2. Predictions

Let us recap the main theoretically salient options of patterns for projection from disjunction, specifically in bathroom sentences: One possibility is that projection from disjunction is entirely symmetric (in contrast to conjunction), without any costs associated for right-to-left filtering. Alternatively, we reviewed two accounts that do posit some level of asymmetry at one level or another:

(25) **Schlenker 2009:** Symmetric filtering is possible in a 'bathroom disjunction', but associated with a processing cost, due to a processing preference for asymmetric projection.

(26) **Hirsch & Hackl 2014:** Presuppositions in the first disjunct of a 'bathroom disjunction' *do* project (maintaining that projection from disjunction is strictly asymmetric), but subsequently get locally accommodated to avoid a clash with NO; local accommodation is assumed to come with its own processing cost (based on prior independent evidence).

Both accounts thus posit an asymmetry of one sort or another between PsFirst and PsSecond, which is associated with a processing cost that, on standard assumptions, should be reflected in a decrease in ratings in an acceptability judgment task. Note that both Schlenker's symmetric filtering cost, and the Hirsch & Hackl local accommodation cost are presupposition-specific and therefore should play no role in the NoPsFirst/Second conditions. Thus, both accounts predict that PsFirst and PsSecond should differ in acceptability to a greater extent than NoPsFirst and NoPsSecond. In other words, both views predict an interaction between Order and PsType.[13]

[13] Note that a non-trivial difference between the account of Schlenker 2009 and Hirsch & Hackl 2014 is what they predict in the case of disjunctions where one of the disjuncts **strictly entails** the presuppositions of the other disjunct, as in (i) below:

(i) **Context:** We find a full pack of Marlboro cigarettes in the dustbin of Mary's office. We have no idea if she

There is furthermore a prediction specific to the local accommodation view. The PsFirst and SimplePs sentences in EI contexts are parallel on this approach, in that they are both acceptable precisely to the extent that local accommodation is available. So, at least on this dimension, they should be equally acceptable relative to controls (there could, of course, be other differences in acceptability reflecting, e.g., their difference in complexity). At the same time, the PsSecond and SimplePs sentences in Support contexts are parallel in that preceding material (either in the local context, in the case of PsSecond, or in the global context, in the case of SimplePs sentences in Support contexts) ensures that the presupposition is entailed in the respective local contexts. So both the SimplePs sentences in Support contexts and the PsSecond sentences should be fully acceptable with regards to evaluating the presupposition. Taking these two parallels together, this means that the local accommodation account predicts that there should be no interaction between the conditions posited to involve local accommodation (EI-SimplePs and PsFirst), and the conditions where the presupposition is supported in its local context (s-SimplePs and PsSecond).

2.3.1.3. Participants & Procedure

251 participants were recruited via Prolific, and after seeing informed consent, each was shown 6 items, one per trigger and condition, in a Latin square design. The SimplePs controls were shown first to establish baselines (either in an EI or S context, in random order), followed by the disjunction conditions (in random order). Participants indicated on a 7-point scale how natural the sentence sounds in the given context. A demonstration version as well as the underlying code

has ever smoked, so we think:

a. Either Mary stopped smoking or she never used to smoke Marlboros.
b. Either Mary never used to smoke Marlboros or she stopped smoking.

A theory like the symmetric Local Contexts of Schlenker 2009 predicts filtering in both cases in (i), as the negation of ‘Mary never used to smoke Marlboros’ entails that ‘Mary used to smoke’.

However, on the Local Accommodation approach of Hirsch & Hackl 2014, (ia) and (ib) are not on par. For (ib), Hirsch & Hackl predict filtering (as in this case the asymmetric version of Local Contexts predicts filtering). But, for (ia), their prediction is one of projection, without repair from Local Accommodation. The reason is that adding the presupposition that Mary used to smoke to the context does not commit the comprehender to the assumption that the second disjunct must be false: it’s perfectly possible for someone to have been a smoker without ever having smoked Marlboros. So, the NO constraint is not violated, and Local Accommodation is not triggered. Thus, in an Explicit Ignorance context, (ia) should lead to infelicity, in a way that (ib) doesn’t.

Our own design aims to probe the role of local accommodation by including the SimplePs conditions. However, future experimental forays into these issues should look into examples like those in (i) in an effort to find convergent evidence with our results. We thank an anonymous reviewer for helpful comments on this, as well as Benjamin Spector, who discussed this issue with us.

and the csv-file containing the full stimuli are accessible at https://farm.pcibex.net/r/bMqAbG/.[14]. The full list of stimuli is also available in appendix A.

2.3.1.4. Results

The overall descriptive pattern of the results is simple, as illustrated in Fig. 2: The S-SimplePs condition appears to have higher ratings, whereas all the others seem to be roughly similar.

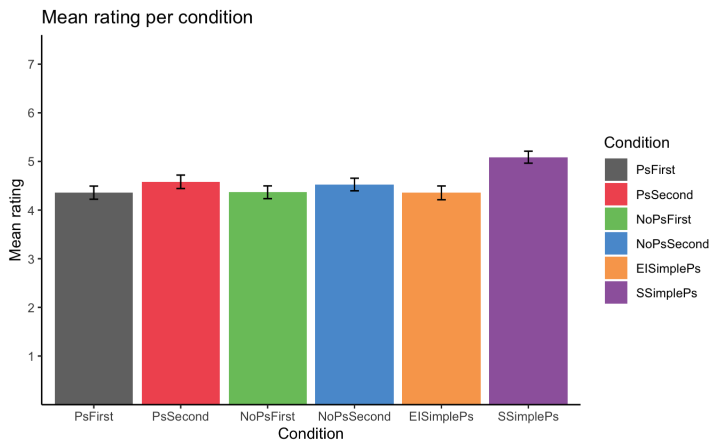

Figure 2.2: Mean acceptability by condition in Experiment 1. Error bars represent standard error.

We conducted statistical analyses from various perspectives to assess the theoretically relevant hypotheses. First, we fit a mixed effect ordinal regression model with a 2×2 interaction for the disjunction conditions. The factors PsType and Order were sum-coded, and the model included random intercepts for both participants and items as well as a random effect slope for PsType by items.[15] There were no significant effects, as detailed in Table 2.1.

While the lack of effects in the interaction analysis is already telling, we also carried out planned comparisons to test for potential effects of Order separately for the Ps and NoPs conditions, using the *emmeans* package with Bonferroni-corrected *p*-values. Order had no significant effect

[14] Click on 'Click here to edit a copy in the PCIbex Farm.' in the top bar to access code and stimuli directly (no account or sign-in needed) on the PCIbex Farm (Schwarz & Zehr, 2021)

[15] Since participants only saw two items per factor level, by-participant random effect slopes could not sensibly be included. The maximal model included a by-item random effect slope for the interaction of Order and PsType; but this did not significantly improved model fit, as confirmed by a likelihood ratio test via model comparison ($p = 0.7278$), and hence was left out of the final model. Including a by-item random slope for Order did not significantly improve model fit either ($p = 0.8713$), and was again left out of the final model. Including the random slope for PsType significantly improved overall model-fit ($p < .001$), and was included in the final model.

	Coeff.	SE	z	p
PsType	-0.02878	0.34660	-0.083	0.934
Order	0.18847	0.11562	1.630	0.103
PsType × Order	0.10994	0.23088	0.476	0.634

Table 2.1: PsType × Order Mixed-effects model summary

on ratings for either Ps ($\beta = -0.133$, $z = -0.808$, $p = 0.8382$) or NoPs ($\beta = -0.243$, $z = -1.507$, $p = 0.2635$). In sum, we find no support for the Order×PsType interaction predicted by asymmetric accounts, nor any effects of order for either the Ps or No-Ps conditions.

The frequentist statistical analyses above fail to reject the null hypothesis, but it would be theoretically relevant, and even more informative, to be able to directly support the absence of an interaction for disjunction in particular. To that end, we also calculated Bayes factor BF_{10} for a parallel Bayesian model with the interaction included and one without the interaction. These models were fitted using the `brms` package in R (Bürkner, 2017, 2018). Since the overall experimental setup is at least reasonably parallel to that of the prior experiment on conjunction by Mandelkern et al. 2020, we use the parameter expectations calculated by a Bayesian ordinal mixed-effects model for that experiment as empirical priors. To calculate Bayes factor, we followed Nicenboim et al. 2022 and used bridge-sampling with the function $bayes\_factor$ provided in `brms`.

We computed the Bayes factor in favor of the model with the interaction, and found a value of $\mathrm{BF}_{10} = .0009$, indicating that the model without the interaction should actually be preferred. Based on the Bayes factor scale from Jeffreys 1939, this constitutes extreme evidence in favor of the simpler model, thus supporting the null hypothesis with regards to the interaction term. In sum, in contrast to the findings by Mandelkern et al. 2020 for conjunction which supported the relevant interaction, our data provide evidence that no such interaction is present for disjunction.

In a second perspective on our data, we fit an ordinal mixed effects regression model with a 2×2 interaction for the four Ps conditions to test for the interaction that is theoretically relevant for the local-accommodation based account of Hirsch & Hackl, as well as for the effectiveness of our context manipulation in the conditional control condition. For this purpose, a new factor SupType (Support

Type) was set up, with the EI-SimplePs and PsFirst conditions coded as NoPriorSupport, and S-SimplePs and Ps-Second as PriorSupport (since the latter two both involve support of the presupposition in the preceding context, assuming standard left-to-right filtering). The second factor was CompType (Complexity Type), with the levels Cond and Disj. Both factors were sum-coded, and an ordinal model including random intercepts for both participants and items as well as a by-item randon slope for CompType was fitted in R.[16] As shown in Table 2.2, there was a significant interaction, as well as a significant effect of SupType (dominated by the interaction, as detailed below).

	Coeff.	SE	z	p
CompType	0.2244	0.3385	0.663	0.507419
SupType	-0.3940	0.1150	-3.427	<.001
CompType * SupType	-0.4917	0.2296	-2.141	<0.05

Table 2.2: SupType × CompType Mixed-effects model summary

To further investigate the nature of the interaction, we conducted planned comparisons to separately test for effects of SupType at the Cond and Disj levels of the CompType factor, using the *emmeans* package with Bonferroni-corrected p-values. SupType had a significant effect on ratings for Cond ($\beta = 0.640$, $z = 3.905$, $p < .001$), but - in line with the same comparison in the PsType×Order analysis above - not for Disj ($\beta = 0.148$, $z = 0.919$, $p = 0.7158$). The main effect of SupType thus seems to be entirely driven by the Cond condition.

In sum, while local-accommodation based asymmetry accounts endorse the null hypothesis of there being no interaction between SupType and CompType - as both EI-SimplePs and PsFirst face the same predicament of no preceding support, leaving local accommodation as the only remedy to reconcile the target sentence with the explicit ignorance context - our statistical analysis allows us to refute that null hypothesis, in that we do find a significant interaction. Furthermore, the significant effect of SupType provides crucial evidence for the validity, sensitivity, and power of our experiment, in that we are able to find effects of missing presuppositional support in the linguistic

[16] Again, since participants only saw two items per factor level, by-participant random effect slopes could not sensibly be included. Based on model comparisons using likelihood-ratio tests, including a random effect slope for the interaction did not significantly improve model fit ($p = 0.6585$). Neither did including a random slope for SupType ($p = 0.7516$).

context for an embedded occurrence of a presupposition trigger in SimplePs. In that light, the absence of any effects of Order in the presuppositional disjunctions indeed suggests that filtering via support of a presupposition from either the first or second disjunct seems to be on par.

2.3.1.5. Discussion

Both the Schlenker 2009 and the Hirsch & Hackl 2014 views posit that something extra, beyond the default and easily available projection mechanism, is at play in PsFirst disjunctions (costly right-to-left filtering for the former, local accommodation for the latter). Thus, the lack of an interaction between PsType and Order (which contrasts with the findings in Mandelkern et al. for conjunction using the same paradigm) - and any effects of order in the Ps conditions - is unexpected under such asymmetric approaches. Moreover, the additional prediction of the local accommodation account, i.e. that SupType should have parallel effects in the SimplePs and the Disj conditions, meaning there should be no interaction between SupType and CompType, is directly refuted by our results, as we do find such an interaction.

The picture that emerges from our data is that PsFirst and PsSecond do not significantly differ in acceptability, and furthermore exhibit no presupposition-based decreases in acceptability, given that they are not found to differ from the NoPs controls. In this respect, our results stand in stark contrast to the findings for conjunction in Mandelkern et al. 2020, where their conjunctive PsFirst was found to be significantly less acceptable than the PsSecond counterpart and NoPs controls.[17] Given the parallel paradigms in our experiment and that of Mandelkern et al., this provides first evidence that conjunction and disjunction indeed are different in terms of their projection behavior. The apparent symmetry between PsFirst and PsSecond for disjunction in our data suggests that any mechanism that is postulated to account for presupposition projection must be sensitive to the differences between a first conjunct and a first disjunct, and not treat them on par.

[17] While we are not able to go into any detailed comparison with other related prior experimental work using different tasks, it's worth noting that our findings align rather well with those for disjunction in Chemla & Schlenker 2012. At the same time, they do contrast somewhat with those in the experiments reported by Hirsch & Hackl 2014, as their task requiring a forced choice between the two disjunct orders in bathroom sentences does indicate some level of asymmetry. However, this need not directly contradict our interpretation of the findings presented here. First, their asymmetry could directly result from the particular task, which requires explicit comparison between the two variants. Secondly, our findings are not in principle incompatible with some amount of processing advantages of left-to-right processing, which our task may not pick up on.

We will turn to more detailed considerations of the theoretical implications of these findings in section 4. However, there are a number of potential criticisms or concerns about the specifics of Experiment 1 that warrant further empirical evidence to solidify the basis for theoretical discussion. First, as laid out in detail above, there are numerous changes from the Mandelkern et al. paradigm in our experiment, which one could use to question how comparable the results are. Second, as an anonymous reviewer points out, Experiment 1 lacks low-acceptability fillers or controls that could be used to ensure that participants are not just being very agreeable (whether out of general charity or because of the relative complexity of our sentences, or any other reason); this could be masking a levelling-out effect of differences that might otherwise be detected (Though we note that at least to some extent, the contrast in SimplePs and the significant interaction in the analysis testing for local accommodation in PsFirst speaks against this possibility). Finally, and expanding on the first point, it would be desirable to have a direct comparison between conjunction and disjuncction with a design and stimuli that are maximally similar. Experiment 2 aims to provide just that.

2.3.2. Experiment 2: A direct comparison of 'and' vs. 'or'

2.3.2.1. Design

Experiment 2 combines the Mandelkern et al. design for conjunction and our own design for disjunction into a single experiment. We created a total of 24 items using 3 triggers (*continue, again, stop*), with 8 items per trigger.[18] Given that we wanted to explicitly contrast disjunctions with conjunctions, and that conjunctions require embedding to differentiate global accommodation and right-to-left filtering (see initial discussion of Mandelkern et al. design above), we decided on a uniform design embedding both conjunctions and disjunctions in the antecedent of a conditional, and ventured to come up with carefully constructed stimuli that are reasonably natural and understandable despite the complexity of embedding the connectives. Thus, our critical items were

[18] The main reason for excluding factive triggers in this experiment was that with conjunctions and disjunction embedded in the antecedent of a conditional, factives create potentially problematic ambiguities:

(i) If Mary either found out that John is cheating on her or John is not cheating on her, then ...

The second disjunct, *John is not cheating on her*, could be interpreted as scoping under *find out*, undermining the functioning of our design. We thus limited ourselves to the three mentioned triggers, which do not suffer from this issue.

PsFirst/Second conjunctions and disjunctions presented in EI contexts, illustrated below.[19]

(27) Conj

a. **Context:** I used to raise Apis bees: these sting a lot, and also die when they sting you, which reduces honey production. But a recently discovered genetic mutation can produce bees which have no sting. Cynthia is interested in honey production, but she has reservations about bees dying. It thus surprised me when I discovered that she had not heard about the genetically modified bees. I don't know if she has ever raised any bees, so I thought:

b. If Cynthia has stopped raising bees, and used to raise Apis bees, then it makes sense that she hasn't heard about this. (PsFirst)

c. If Cynthia used to raise Apis bees, and has stopped raising bees,then it makes sense that she hasn't heard about this. (PsSecond)

(28) Disj

a. **Context:** I used to raise Apis bees: these sting a lot, and die when they sting you, which reduces honey production. But a recently discovered genetic mutation can pro-

[19] As pointed out to us by Ashwini Deo and David Beaver (pc), our conjunction stimuli included two items where the non-presuppositional conjunct involved the lexical item "only". An example is presented below:

(i) a. If Kat has stopped doing spelunking and has only done spelunking in easy caves, then this trip is not for her. (PsFirst)

b. If Kat has only done spelunking in easy caves and has stopped doing spelunking, then this trip is not for her. (PsSecond)

Here, the conjunct containing "stop" is the presuppositional one, whereas the other conjunct contains information that entails the presupposition of the presuppositional conjunct (in this case that "Kat used to do spelunking"). The issue here is that if we take "only" to presuppose the truth of its prejacent, then these conjunctions involve two presuppositional conjuncts. In that case, what we are calling Ps-Second in fact is akin to a PsFirst type of stimulus. This is potentially problematic as the PsFirst vs PsSecond contrast we are after is potentially obliterated in these items.

Two points are in order here: 1) the potentially problematic items involved only *two* out of *twenty four* conjunction stimuli. So, there should be enough stimuli to counterbalance any problems that these two stimuli might be creating. 2) This sense is confirmed by the fact that when we remove the problematic conjunction items (removing also the corresponding items for disjunction) the statistical picture remains unchanged: the same three-way interaction between Connective, Order and PsType that we report in section 3.2.4 comes out equally strongly. Thus, we do not believe that the presence of "only" in the two conjunction items represents significant cause for concern.

duce bees which have no sting. Cynthia is interested in honey production, but she has reservations about bees dying. It thus surprised me when I discovered that she had not heard about the genetically modified bees. I don't know if she has ever raised any bees, so I thought:

b. If Cynthia either has stopped raising bees or has never raised any bees, then it makes sense that she hasn't heard about this. (PsFirst)

c. If Cynthia either has never raised any bees or has stopped raising bees, then it makes sense that she hasn't heard about this. (PsSecond)

As before, for each presuppositional sentence, we include a non-presuppositional version (Conj/Disj-NoPsFirst/Second) as well, to control for any potential order-related effects unrelated to presupposition. The crucial presupposition-based effects can then be isolated via decreases in acceptability of PsFirst relative to PsSecond that exceed any (potential) parallel decreases for the NoPs variants.

(29) Conj

a. If Cynthia frowns upon raising bees and used to raise Apis bees, then it makes sense that she hasn't heard about this. (NoPsFirst)

b. If Cynthia used to raise Apis bees and frowns upon raising bees, then it makes sense that she hasn't heard about this. (NoPsSecond)

(30) Disj

a. If Cynthia either frowns upon raising bees or has never raised any bees, then it makes sense that she hasn't heard about this. (NoPsFirst)

b. If Cynthia either has never raised any bees or frowns upon raising bees, then it makes sense that she hasn't heard about this. (NoPsSecond)

As these examples show, the conjunction stimuli are identical to the disjunction stimuli up to choice of connective and the non-presuppositional conjunct (apart from the presence of 'Either'; see footnote 9): the latter still asymmetrically entails the presuppositions of the presuppositional conjunct in conjunctions, but not in disjunctions. Moreover, minor variations in the contexts for conjunctions vs disjunction were sometimes necessary to accommodate the impact of their different meanings. Note also that the disjunctions do not include the extra conjunct they carried in Experiment 1.

Parallel to Experiment 1, we used simple (i.e., not coordinated) sentences with the presupposition trigger embedded in the antecedent of conditionals, in Support (S) and Explicit Ignorance (EI) contexts, as controls to establish baselines for local accommodation and presuppositional support:

(31) a. **EI Context:** I'm organizing a spelunking trip to a difficult cave. Back in college, Kat had an interest in extreme sports, although I don't know how she feels about the dangers involved in them these days. Also, I have no idea if she ever actually tried spelunking. So, I thought:

b. **S Context:** I'm organizing a spelunking trip to a difficult cave. Back in college, Kat had an interest in extreme sports, although I don't know how she feels about the dangers involved in them these days. I know that in college she often used to go spelunking. So, I thought:

c. If Kat has stopped doing spelunking, then this trip is not for her. (SimplePs)

Additionally, 24 fillers of two types were included, illustrated in (32)-(33) (12 of each type).

(32) a. **Context:** The Louvre has a new exhibition of medieval art. Melanie is an art critic and is in Paris to review the new exhibition. So I thought:

b. If Melanie isn't in Paris then something must have happened on her trip. (BadCond)

(33) a. **Context:** My friend Saul is a philosopher and has been working on a new theory for

the past year. However, he has been very secretive about it. Yesterday he told me that he was almost done with the work, but given how secretive he has been I'm not sure whether he will publish it. So, I thought:

b. If Saul publishes his new theory, then that will make the other philosophers very excited.

(GoodCond)

The Good/BadCond fillers were designed to implement the following manipulation (present also in the fillers of Mandelkern et al.): generally, for a conditional to be felicitous, the antecedent must not be excluded as a possibility in the context. In GoodCond fillers, this requirement was fulfilled, while in BadCond fillers, it was not, allowing for an independent assessment of sensitivity to pragmatic infelicity of broadly comparable severity in the task. Introducing another source of infelicity in the items that are presented also served to distracting participants from our critical manipulation.

2.3.2.2. Predictions

Accounts that take projection to display an asymmetry uniformly across connectives predict that PsFirst should be worse than PsSecond for both disjunctions and conjunctions, whereas no such difference should be found for the NoPs conditions. Thus, for both connectives the Order the conjuncts appear in should have parallel effects on acceptability based on the PsType of a sentence. Conversely, if filtering is asymmetric in conjunctions but symmetric in disjunctions, then we predict that PsFirst should be worse than PsSecond for conjunctions. For disjunction, this predicts that PsFirst should be equally acceptable to PsSecond. In both cases, these patterns should hold relative to any potential independent order-based differences in the NoPs conditions. In other words the effects of Order on acceptability should vary based on the PsType of a sentence for conjunctions, but not for disjunctions, so a three-way interaction is predicted between Connective, Order and PsType status, driven by a 2×2 Order-PsType-interaction for conjunction, parallel to Mandelkern et al.'s that is not present for disjunction.

2.3.2.3. Participants & Procedure

The CONNECTIVE and PSTYPE factors were between-subjects, following the approach in Mandelkern et al. Accordingly, the items were divided into 4 lists (2 choices for CONNECTIVE and 2 choices for PS status), and each participant saw items for either conjunction or disjunction, and consistently with one kind of PSTYPE. Thus one of the conjunction lists contained all the PSFIRST/SECOND conjunctions together with the EI-SIMPLEPS items, plus all the fillers. The other conjunction list contained all the NOPSFIRST/SECOND conjunctions together with the S-SIMPLEPS items, plus all the fillers. Similarly for the two disjunction lists. Each list was counterbalanced with a Latin square design. 203 native English speakers were recruited from our university's subject pool, and after seeing informed consent, each participant was shown one of the aforementioned four lists of items. The items were presented in random order, with every participant seeing 48 items (24 critical and 24 fillers). Participants were asked to indicate on a 9-point scale how natural each sentence sounded in the given context.[20] A demonstration version as well as the underlying code and the csv-file containing the full stimuli are accessible at https://farm.pcibex.net/r/IfRrjY/. The full list of stimuli is again available in appendix A.

2.3.2.4. Results

Figure 3 shows the pattern of results for conjunction and disjunction. Starting from the the SIMPLEPS conditions we see differences between S-SIMPLEPS and EI-SIMPLEPS in both the conjunction and the disjunction data. We fit ordinal mixed-effects models to subsets of the data containing only the SIMPLEPS conditions, predicting Rating from condition (levels: S-SIMPLEPS and EI-SIMPLEPS) for each connective. The models included by-participant and by-item random intercepts, as well as a by-item random slope for condition.[21] Both the models for conjunction and for disjunction revealed a statistically significant difference between S-SIMPLEPS and EI-SIMPLEPS (CONJ: $\beta = 2.95$, $SE = 0.35$, $z = 8.33$, $p < 0.001$, DISJ: $\beta = 1.72$, $SE = 0.34$, $z = 5.06$, $p < 0.001$). This confirms

[20] The increase to 9 points was an attempt to improve chances to detect subtle contrasts. As pointed out by an anonymous reviewer, though, increasing the points on a Likert scale beyond 7 is non-standard and may not be the best way to try to achieve greater sensitivity in one's response variable. In light of our solid set of findings below, we do not see any concern that issues based on that interfered with the effect of our manipulations.

[21] As every participant saw only one kind of SIMPLEPS sentence, by-participant random slopes for condition could not sensibly be included in the model.

that our design can indeed detect acceptability differences due to presupposition projection.

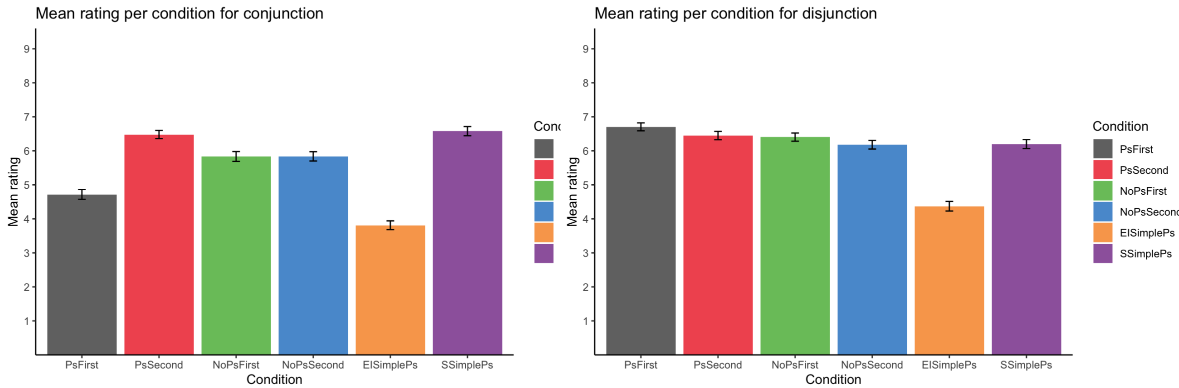

Figure 2.3: Mean Acceptability rating per condition by connective in Experiment 2. Error bars indicate standard error.

We move on to the crucial three-way interaction between CONNECTIVE, ORDER, and PSTYPE in the conditions with connectives. A visual inspection of the plots suggests a clear difference in acceptability between PSFIRST and PSSECOND for conjunction, but not for disjunction. Importantly, in both conjunction and disjunction the NOPS conditions are parallel to one another, suggesting that no substantial presupposition-independent order effects are at play.

To assess the corresponding 3-way interaction statistically, we combined the data from the four lists. The following two-level factors were set up: CONNECTIVE (CONJ vs DISJ), PSTYPE (PS vs NOPS) and ORDER (FIRST vs SECOND), all sum-coded. We then fit an ordinal mixed effects model predicting Rating from CONNECTIVE, PSTYPE status, ORDER and their (2- and 3-way) interactions. The model also included a by-participant random slope for ORDER, and by-item random slopes for PSTYPE and CONNECTIVE.[22] The output of the model is summarized in Table 3:

There is a highly significant three-way interaction between CONNECTIVE, PSTYPE and ORDER. There also are overall 2-way interactions between CONNECTIVE and ORDER and PSTYPE and ORDER, as well as a main effect of ORDER, but these are all dominated by the 3-way interaction.

[22] As each participant only saw items with one CONNECTIVE and PSTYPE, by-participant random slopes for these factors could not sensibly be included in the model. The maximal model that converged included by-item and by-participant random intercepts. It also included a by-participant random slope for ORDER, and by-item random slopes for PSTYPE, ORDER and CONNECTIVE, and their interaction. Including the by-participant random slope for the interactions of PSTYPE, ORDER and CONNECTIVE did not significantly improve model-fit, ($p = 0.95$). Neither did the inclusion of the by-participant random slope for ORDER ($p = 0.79$). Therefore, our final model left these out.

	Coeff.	SE	z	p
ConnectiveCONJ	-0.48025	0.15355	-3.128	$< .01$
PsTypePs	0.01624	0.25108	0.065	0.948419
OrderFirst	-0.37058	0.08072	-4.591	$< .001$
ConnectiveCONJ×PsTypePs	0.22331	0.19155	1.166	0.243687
ConnectiveCONJ×OrderFirst	-0.49636	0.08078	-6.145	$< .001$
PsTypePs×OrderFirst	0.42043	0.11357	3.702	$< .001$
ConnectiveCONJ×PsTypePs×OrderFirst	0.42050	0.11346	3.706	$< .001$

Table 2.3: Connective × PsType × Order Mixed-effects model summary

To assess the nature of the latter in more detail, we also carried out planned comparisons of the PsType × Order interactions for each Connective separately , using the *emmeans* package with Bonferroni-corrected p-values. For disjunction, there is no significant PsType × Order interaction effect ($\beta = 0.000142$, $z = 0$, $p = 0.9996$). But for conjunction, we do get a significant PsType × Order interaction ($\beta = -1.681845$, $z = -5.157$, $p < .0001$). This confirms that our three-way interaction is driven by the presence of a significant PsType × Order interaction for conjunction, which is absent for disjunction.

As was the case with Experiment 1, it is of theoretical interest to assess the evidence in favor of the null hypothesis with respect to the 2-way interaction term for disjunction. We again turn to Bayesian analyses and a calculation of Bayes factor BF_{10}, as for Experiment 1, for versions of the model for the disjunction data with and without the interaction. Since the best point of comparison (in terms of comparability of conditions and materials) is the conjunction data from Experiment 2, we use the parameter expectations from a Bayesian analysis of these as priors for the disjunction models.[23] The calculation of Bayes factor in favor of the model with the interaction term included yields $BF_{10} = 0.00117$, indicating that the model without the interaction (i.e., the equivalent of assuming that the interaction parameter equals zero) should actually be preferred. Parallel to what we found for Experiment 1, this constitutes extreme evidence in favor of the simpler model (Jeffreys, 1939), thus supporting the null hypothesis with regards to the interaction term. In sum, while our new conjunction data replicate the crucial interaction of Mandelkern et al. 2020, the Experiment 2

[23]Note that these were relatively close to those for the original Mandelkern et al. 2020 data, so this choice did not amount to all that much of a material difference.

disjunction data provide further evidence, adding to what we already found for Experiment 1, that no such interaction is present for disjunction.

Parallel to our test of the predictions of Hirsch & Hackl 2014 for Experiment 1, the other theoretically-relevant question to ask (of the disjunction part of our data) is whether the presence of material capable of supporting a presupposition in one of the disjuncts has a significant effect on acceptability, compared to cases where no such support exists. As above, we set up a two-level CompType factor that tagged PsFirst/Second disjunctions as Complex, while EI/S-SimplePs conditionals were tagged as Simple. Another two-level factor, SupType, tagged the relevant sentences by the kind of prior support that existed for the presuppositions in them: EI-SimplePs and PsFirst sentences were tagged as NoS (i.e. 'No prior support'), while S-SimplePs and Ps-Second sentences were tagged as S (i.e., 'Prior Support'). The factors were sum-coded. We then fit an ordinal mixed-effects model predicting Rating from CompType, SupType and their interaction. The model also included by-participant and by-item random intercepts, as well as by-item random slopes for CompType, SupType and their interaction, as well as by-participant random slopes for CompType.[24] The results of this model are summarized in the following table:

	Coeff.	SE	z	p
CompTypeComplex	0.58328	0.16719	3.489	$< .0001$
SupTypeNoS	-0.39525	0.09656	-4.093	$< .0001$
CompTypeComplex×SupTypeNoS	0.52599	0.09804	5.365	$< .0001$

Table 2.4: CompType × SupType Mixed-effects model summary

As Table 2.4 shows, there is a highly significant interaction between CompType and SupType. To assess the nature of this in more detail, we also carried out planned comparisons of the differences between the Simple and Complex levels of the CompType factor separately for each level of the SupType factor, using the *emmeans* package with Bonferroni-corrected p-values. We found that

[24]Since not every participant saw both kinds of SupType sentences (some only saw SSimplePs), a by-participant random slope for SupType could not sensibly be included. Thus, the maximal model we could fit predicted Rating from CompType, SupType and their interaction, and included by-participant and by-item random intercepts, as well as by-item random slopes for CompType, SupType and their interaction, and a by-participant random slopes for CompType. Model comparison revealed that including the by-item random slope for the interaction of CompType and SupType significantly improved model fit ($p = 0.01614$). So did including the by-participant random slope for CompType ($p < .001$).

while the difference between SIMPLE and COMPLEX is not significant in the S case of the SUPTYPE factor ($\beta = 0.115$, $z = 0.283$, $p = 0.7770$), there is a very significant difference between the two in the NOS case ($\beta = 2.219$, $z = 5.998$, $p < .0001$). This replicates Experiment 1 in this respect, again countering the prediction of a Hirsch & Hackl 2014-style account assuming local accommodation as the source of preventing projection from an initial presuppositional disjunct in bathroom sentences.

2.3.2.5. Discussion

Experiment 2 clearly and directly establishes that **conjunction and disjunction are not the same** in terms of the effect of linear order on their projection properties. As in Mandelkern et al. conjunctions exhibit a PSFIRST/SECOND contrast with an advantage for the latter, where the presupposition is supported by the *preceding* context, reflected in the two-way interaction between ORDER and PSTYPE. Crucially, the effect of linear order on projection from disjunction significantly differs from that of conjunction in comparison to controls, as reflected in the three-way interaction between CONNECTIVE, PSTYPE and ORDER. The calculation of Bayes factor for models of the disjunction data including vs. not including the two-way interaction between ORDER and PSTYPE furthermore provides direct evidence that this interaction is absent for disjunction altogether. Additionally, we replicate the interaction between COMPTYPE and SUPTYPE that we found in Experiment 1, suggesting that local accommodation is not operative in PSFIRST disjunctions, as we do find a decrease in acceptability for local accommodation in simple conditionals, but not in PSFIRST disjunctions.

2.4. Theoretical Implications

2.4.1. Constraints on a Theory of Projection

Let's consider theoretical options in light of our finding that projection from disjunction is symmetric. The obvious option (call this Option 1) is that in the case of disjunction, righ-to-left filtering is available **without incurring any extra cost** (at least none that is measurable in our task). This would capture the three-way interaction found in Experiment 2, and it would also explain the fact that this interaction is driven by a significant interaction between PSTYPE and ORDER in the case of conjunction, which is absent for disjunction.

The only other option we see that one could in principle consider is that genuine filtering is not at play in disjunction at all (call this Option 2): Geurts 1999, for example, argues that presuppositions generally project from both disjuncts, yielding across the board symmetric projection rather than filtering. Absence of projection, e.g., in 'bathroom' disjunctions, then requires invoking a different mechanism, and local accommodation fits the bill (parallel to the Hirsch & Hackl proposal for presuppositions in the first disjunct of a bathroom sentence, but generalized to both orders), with no obvious alternatives. Let us note here already that this option has a conceptual disadvantage when considering the broader picture, in that it does not seem compatible with a general and explanatory approach to projection, in the spirit of Schlenker 2009 (in contrast to the first option above, see Section 2.4.4 below for more details).

But in purely empirical terms, this type of approach crucially predicts, parallel to the Hirsch & Hackl proposal, that the local accommodation of presuppositions in bathroom disjunctions incurs a penalty due to processing difficulties. More specifically, under the assumption - unchallenged in the literature, as far as we're aware - that the cost of local accommodation does not vary across environments, this penalty should be comparable to the one found in our SimplePs conditions, where a presupposition is locally accommodated in the antecedent of a conditional. But then we can compare whether the difference between the SimplePs conditions parallels any differences between PsFirst vs NoPsFirst on the one hand, and any differences between PsSecond vs NoPsSecond on the other: on a theory with symmetric local accommodation for PsFirst/Second, all these differences should parallel one another, predicting the absence of an interaction. Perhaps unsurprisingly given the overall results pattern, corresponding statistical analyses reveal decreases in acceptability based on local accommodation for SimplePs, but no parallel effects for either disjunction order.[25]

[25]To evaluate this we set up the following factors: LocAcc (levels: LocAcc vs NoLocAcc), which tagged the disjunction data as either involving Local Accommodation on the Geurts 1999 theory or not. The other factor was CompType (levels: COND, DISJ1, DISJ2), which tagged the data depending on whether they were a conditional, a (No)PsFirst disjunction, or a (No)PsSecond dsijunction. We then fitted an ordinal mixed effects model predicting Rating from these two factors and their interaction. The model also included by-participant and by-item random intercepts, as well as a by-participant random slope for CompType, and by-item random slopes for CompType and LocAcc. Using the *emmeans* package we carried out planned comparisons of the difference between the LocAcc levels for each level of CompType. This revealed a significant difference between LocAcc and NoLocAcc only in the case when CompType = $COND$, i.e. only for the SimplePs sentences ($\beta = -1.81, z = -5.172, p < .0001$). In the cases when CompType = $DSIJ1$ or CompType = $DSIJ2$, no significant difference exists between LocAcc and NoLocAcc. This contradicts the predictions of the Geurts 1999 approach, as there should be a meaningful

Note, furthermore, that all disjunction versions are rated higher than EI-SimplePs. Finally, recall that our previous analyses of the disjunction conditions in Experiment 2 revealed no main effect of PsType, again in line with there not being any penalty for either PsFirst or PsSecond relative to NoPs. All of this speaks against an analysis based on symmetric local accommodation for both disjunct orders, and seems to leave Option 1 (i.e., symmetric filtering without a cost) as the only game in town.

On a more general level, it is important to note that neither option above is compatible with a domain general projection mechanism that posits **uniform** effects of linear order on conjunction and disjunction. With regards to existing theories of projection, the issue most relevantly extends to Schlenker 2009, which posits both a symmetric and an asymmetric filtering mechanism to be available across the board. If there are two such filtering mechanisms and they are both equally available across connectives, then we expect to see no difference between conjunction and disjunction in projection (a-)symmetries. If, on the other hand, one of these mechanisms is taken as a default, with the other available at some processing cost, then we have the following possibilities:

- Asymmetry is the default, Symmetry is costly: this predicts the existence of symmetric conjunction at a cost, plus a default-based asymmetry for disjunction. Our data, together with the results from Mandelkern et al. show that neither of these predictions is borne out.

- One could in principle also conceive of an alternative conceptual setup of the two mechanisms, such that (ii) Asymmetry is costly, and Symmetry is the default. But this predicts symmetry (without any cost!) for conjunction and thus is incompatible with the Mandelkern et al. results, as well as our parallel order effects for conjunction.

Therefore, we are left in a situation where the differences in projection properties of conjunction and disjunction cannot be captured by positing two filtering mechanisms that are uniformly available across connectives. One potential further reaction to maintain this perspective might be to still postulate two filtering mechanisms, but have their availability vary across individual connectives.

difference between LocAcc and NoLocAcc for all levels of the CompType factor.

That, however, amounts to lexical specification of projection properties, with the corresponding loss of explanatory power and undermining the basic motivation that this type of account started out with. This leaves us with the option of exploring other formulations of projection mechanisms that apply uniformly across connectives but with varying effects. Distinct projection properties should then derive from the way such mechanisms interact with other lexically specified properties, most plausibly their underlying truth conditions. In the remainder of this section, we discuss how different theoretical approaches relate to this space of options.

2.4.2. Dynamic Semantics

Dynamic semantics (Heim 1983b and much subsequent work) owes the central role it has played in presupposition theory to its powerful capacity for specifying context change potentials (CCPs) to model desirable projection properties of embedding expressions, connectives, and quantifiers. On the flip-side, this very power also has led to criticism based on the explanatory challenge we've already discussed in detail. And yet, despite being so powerful, coming up with a proper dynamic treatment corresponding to Option 1 in the previous section (i.e,. implementing symmetric filtering for disunction) is in fact problematic.

In dynamic semantics, the meaning of a sentence S is viewed as function that takes a context (most simply construed as a set of worlds C) and returns a new context C' that is (on this simple construal) the intersection of C and the proposition p corresponding to the traditional meaning of S. In the case of a conjunction, this gives us the following update rule:

(34) $C[\alpha \textit{ and } \beta] = (C[\alpha])[\beta] = (C \cap [\![\alpha]\!]) \cap [\![\beta]\!]$

This rule re-writes the CCP for a conjunction in terms of the individual CCPs of the conjuncts: the CCP of a conjunction is that function that first applies the CCP of the first conjunct α to the context C, and then applies the CCP of β to $C[\alpha]$ (the *result* of applying $[\![\alpha]\!]$ to C). This has the effect of ridding C of any worlds where (the underlying propositions of) α and β are false, which captures the classical truth-conditional meaning of conjunction.

What about the definedness conditions of $C[\alpha \textit{ and } \beta]$? Dynamic semantics assumes that for a complex CCP to be defined, every simple CCP application involved in rewriting it must be defined (this corresponds to the so-called Weak Kleene recipe for dealing with combinations of undefinedness, cf. Rothschild 2011). Thus $C[\alpha \textit{ and } \beta]$ is defined iff $(C[\alpha])[\beta]$ is defined; this, in turn, is defined iff applying $[\![\alpha]\!]$ to C is defined, and applying $[\![\beta]\!]$ to $C[\alpha]$ is defined. If α carries a presupposition, then C must entail it, otherwise $C[\alpha]$ will be undefined. And if β carries a presupposition, then $C[\alpha]$ must entail it, in order to avoid undefinedness. This amounts to asymmetric filtering conditions for conjunction, as β is interpreted relative to a context resulting from applying $[\![\alpha]\!]$ to the original C.

The explanatory challenge for dynamic semantics is that there are several CCPs one can define for a given connective that are truth-conditionally equivalent, but vary in terms of definedness conditions (Soames 1982; Heim 1990; Schlenker 2008). In particular, we could just as well specify the following rule for conjunction:

(35) $C[\alpha \textit{ and } \beta] = (C[\beta])[\alpha]$

Set-theoretically, $(C[\beta])[\alpha] = (C[\alpha])[\beta]$, if defined. However, for $(C[\beta])[\alpha]$ to be defined, on this rendering, β must be defined in every C-world, and α must be defined in every β-world in C (so a presupposition in α is filtered if it is entailed by β). In other words, we get reverse-filtering conjunction, yielding a right-to-left asymmetry - which does not seem to be attested in natural languages.

Can we specify a symmetric filtering version of disjunction, in line with Option 1 in the previous section, in dynamic semantics? It turns out, that there is no single dynamic rule that can make disjunction symmetric (as first observed in Rothschild 2011). To see why, consider the filtering requirements imposed on us by 'bathroom disjunctions': the first disjunct must be evaluated in a context where we have already incorporated the negation of the second disjunct. At the same time, simple disjunctions tell us that the second disjunct must be evaluated against a context where the negation of the first disjunct has been incorporated. Trying to state these requirements in a dynamic rule, one might propose the following:

(36) $C[\alpha \textit{ or } \beta] = C[\neg\beta][\alpha] \cup C[\neg\alpha][\beta]$

But recall that for a complex CCP to be defined, **every** simple CCP-application step in which it is re-written must be defined. This means that $C[\neg\beta][\alpha]$ must be defined, and $C[\neg\alpha][\beta]$ must be defined; for these to be defined, $C[\alpha]$ and $C[\beta]$ must be defined respectively (as $C[\neg\alpha] = C - C[\alpha]$). But then a disjunction will always be undefined if either of its disjuncts carries a presupposition that is not entailed by C, irrespective of the entailments of the other disjunct. In other words, we wind up with the equivalent of Option 2 above, with no filtering in disjunction at all.

To get symmetric disjunction one needs to postulate access to two distinct CCPs to encode Left-to-Right and Right-to-Left filtering respectively:[26]

(37) a. $C[\alpha \textit{ or } \beta] = C[\alpha] \ \cup \ C[\neg\alpha][\beta]$

- (defined iff all worlds in C satisfy the presupposition of α and all worlds in C where α is False satisfy the presuppositions of β)

b. $C[\alpha \textit{ or } \beta] = C[\beta] \ \cup \ C[\neg\beta][\alpha]$

- (defined iff all worlds in C satisfy the presupposition of β and all worlds in C where β is False satisfy the presuppositions of α)

This is precisely the position adopted by Rothschild 2011, whose dynamic system provides access to these two rules by taking all possible re-write rules for complex CCPs to be in principle available (thus avoiding the explanatory challenge). However, this setup also allows access to both (34) and (35) for conjunction, thus predicting the in-principle availability of symmetry for conjunction as well (much like Schlenker's two mechanisms proposal). One can again introduce a general source

[26]One can also consider getting out of this by changing the recipe by which definedness is calculated in dynamic semantics to the Strong Kleene recipe; but this is of no general help, as it would just shift the difference between conjunction and disjunction to how definedness has to be calculated for them.

for asymmetry to try to fix this, e.g., by adding an order-constraint on possible re-write rules to the effect that either exclusively or preferably makes (34) and (37a) available for conjunction and disjunction (see Rothschild 2011 for details). However, this in turn produces asymmetry uniformly across connectives, thus failing to capture the difference in projection properties between conjunction and disjunction in our experimental results.

Therefore, dynamic semantics is not suited to giving us a symmetric lexical entry for disjunction and an asymmetric one for conjunction at the same time in a non-stipulative way. In fact, the only direct option for symmetric disjunction in just one lexical entry corresponds to (the already discarded) Option 2 above, positing the symmetric *absence* of filtering in disjunction. Finally, whichever route is taken here, the explanatory challenge remains, for even if one can capture the empirical patterns (at least to a great extent), stipulative choices about the context change potentials or projection machinery in play for the different connectives have to be made.

2.4.3. Trivalent Semantics

Trivalent theories assume three truth values: $True, False$ and # (undefined). # is used to capture presupposition failure. Presupposition projection is modeled by the way the # value does or does not percolate in complex sentences. Projection properties of connectives are then determined by the distribution of # in their trivalent truth tables. The truth tables for conjunction and disjunction that encode the projection properties we are trying to capture based on our results are as follows:

(38)

pq	T	F	#
T	T	F	#
F	F	F	F
#	#	#	#

Asymmetric trivalent conjunction

(39)

pq	T	F	#
T	T	T	T
F	T	F	#
#	T	#	#

Symmetric trivalent disjunction

In conjunctions, if the first conjunct is #, then the entire conjunction is always #, regardless of the truth value of the second conjunct. This corresponds to a presupposition in the first conjunct always projecting, regardless of the status of the second conjunct. Presuppositions in the second conjunct, however, need not lead to a presupposition of the entire sentence: if the first conjunct is false, the entire sentence is automatically false. This setup yields the equivalent of asymmetric filtering: if p entails the presupposition of q and p is true, then q cannot be undefined; if p entails the presupposition of q and p is false, then the entire sentence is false.

In contrast, in the truth table specified here for disjunction, if one disjunct is #, this percolates to the whole disjunction just in case the other disjunct is F or $\#$. If the second disjunct is T, then the whole disjunction is T. Given this, consider a 'bathroom disjunction' of the form p *or* q, where p carries a presupposition p', and $\neg q \models p'$. In all worlds w where p' is false, q will be true (by modus tollens). By the truth table above, the whole disjunction will be true, then; and such a disjunction will never be #, which means that no projection occurs in these types of sentences - we get symmetric filtering.[27] Thus, trivalent semantics is capable of delivering asymmetric filtering for conjunction but symmetric filtering for disjunction.

We need to consider the explanatory challenge raised for dynamic semantics for this type of approach, too, however. Why are these entries chosen, and not others? It may seem like this inevitably requires lexical stipulation. However, as George 2008b remarkably shows, these tables can be derived via one general algorithm, stated below as Algorithm 1 (we are simplifying here; see George 2008b for full details).

With Algorithm 1 in mind, take a conjunction where the first conjunct has the # value. There is no way that the second conjunct can have a value that will make the entire conjunction True on the classical table. Thus, the entire conjunction is assigned #. Disjunction is different. If the first disjunct has the # value, all is not lost. If the second disjunct is True, then we can assign True to the entire disjunction by the classical table. If it is False, the classical truth table gives us no information, so we assign # to the entire disjunction. This yields the trivalent truth tables above.

[27] Note that when the presupposition of one disjunct is unrelated to the other disjunct, this trivalent approach and, say, a dynamic semantics variant with both CCPs in (37a) and (37b) differ from one another, in that the former predicts no impact of a presupposition of one disjunct as long as the other is true; whereas both of the dynamic entries predict undefinedness in such a case. We won't pursue this difference here further, as the current focus is on capturing symmetric filtering from disjunction.

Given ($\alpha \; * \; \beta$) (where $*$ is a binary connective), consider first α
if *on the basis of the truth value of α and the classical semantics of the $*$ connective, you can assign a truth value to the whole sentence,* **then**
  do so;
else
  if *there exists a possible truth value for β that can make the sentence True on the classical truth table,* **then**
    check the value of β:
    if *the classical truth table assigns a value to sentence on the basis of the value of α and β* **then**
      Assign that value to the whole sentence;
    else
      assign # to the whole sentence;
    end
  else
    assign # to the whole sentence;
  end
end

Algorithm 1: The algorithm of George (2008b)

Thus George's trivalent account with the linear-order driven algorithm succeeds in capturing the varying impact of linear order on projection from conjunction and disjunction.

Does the variation in projection (a-)symmetry across connectives require a trivalent setup, or are there alternative ways of modeling this? We now turn to a new proposal capturing the pattern in a bivalent system.

2.4.4. Limited Symmetry

Kalomoiros (2022a) introduced the idea of a novel projection system, *Limited Symmetry*, which is inspired by Schlenker (2008, 2009) but also takes into account insights of George's on grounding the varying impact of linear order in the connectives' truth conditions. The core aim is to derive asymmetric conjunction but symmetric disjunction through a single filtering mechanism, in line with the empirical data reported above. The following gives a brief and basic introduction, leaving a more detailed and full-fledged discussion and evaluation for another occasion.[28]

[28] The presentation here diverges from Kalomoiros (2022a) to avoid some issues and increase concision and accessibility.

2.4.4.1. The general idea

First, some notation: following Schlenker, $p'p$ indicates a proposition with a presuppositional component p' and a non-presuppositional component p. The meaning of $p'p$ is the conjunction of p' and p in a classical, bivalent semantics. What is the impact of p' when a comprehender encounters $p'p$ as a simple sentence? At the core is the fundamental intuition, going back at least to Stalnaker's seminal work, that presuppositions should be non-informative - they are already taken for granted. Crucially, this non-informativity should be assessed independently of the assertive component p: at least for some triggers, it has been proposed that their assertive component entails the presupposition, and this shouldn't trivially count as non-informativity, (Schlenker, 2007).[29] We can assess the non-informativity of p' independently of p by substituting the latter with an arbitrary D, and then proceeding to check that $p'D$ and D are equivalent in context C: this requires that all worlds in C where $p'D$ is true are worlds where D is true; and all worlds in C where $p'D$ is false are worlds where D is false. This holds iff every world in C is a p'-world - the core of our Non-Informativity constraint.[30]

What about cases where $p'p$ occurs in a complex sentence, such as ($p'p$ *and* q)? Extending the above, we require that ($p'D$ *and* q) and (D *and* q) have to be contextually equivalent. This can be broken down into checking that for all D and for all worlds in the context C:

- All the C-worlds where ($p'D$ *and* q) is true are worlds where (D *and* q) is true.
- All the C-worlds where ($p'D$ *and* q) is false are worlds where (D *and* q) is false.[31]

But moreover, integrating the idea of incremental presupposition evaluation in Asymmetric Local Contexts, we require that this equivalence hold (so far as it be determined) for every partial

[29]Thanks to two anonymous reviewers, our editor Yasu Sudo, as well as Philippe Schlenker for helpful feedback and discussion on this point that led to some substantial re-framing in the formulation of the analysis.

[30]This Non-Informativity constraint also underlies Phillipe Schlenker's *Transparency* constraint, from which *Limited Symmetry* is heavily inspired. Since *Transparency* theory is equivalent to Local context (Schlenker, 2009), it faces the same problem of not being able to derive symmetry for disjunction but asymmetry from conjunction from a **single** mechanism. For reasons of space then, we eschew a presentation of *Transparency* theory here, deferring a more systematic comparison to a future occasion.

[31]This is simply the contrapositive of "All the worlds where (D *and* q) is true are worlds where ($p'D$ *and* q) is true".

sub-string from the moment of encountering $p'p$.[32]

For example, in the case of ($p'p$ *and* q), upon encountering $p'p$, we have access to the partial string `(p'p and`. The requirement is that in all worlds where we can determine `(p'D and` to be true no matter the continuation, `(D and` also needs to be true no matter the continuation (for all D). Similarly, in all worlds where we can determine `(p'D and` to be false no matter the continuation, `(D and` also needs to be false no matter the continuation (for all D).

At parsing point `(p'D and`, we know that the sentence is already false (for all D) in all worlds where $p'D$ is false. Similarly, `(D and` is already false (for all D) in worlds where D is false.

So we can check whether all these worlds where $p'D$ is false are worlds where D is false, and if not, it follows that the contextual equivalence required to hold throughout all partial parses does not hold. We will see below that this holds just in case p' is true in all worlds in C.

Crucially, due to the different truth conditions in play for disjunctions, no such determination is possible at the equivalent parsing point `(p'p or`, effectively leading to consideration of the second disjunct in evaluating a presupposition in the first disjunct. We demonstrate this with a more formal illustration of the constraints and their application.

2.4.4.2. Definitions

The core of *Limited Symmetry* is an incrementally applicable Non-Informativity constraint for sentences containing presuppositional statements of the form $p'p$ in a given context C:

(40) **Non-Informativity Constraint**: A presuppositional component p' of a sentence S beginning with a string of the form $\alpha\ p'p$ has to be non-informative in context C, in the following sense: for every t such that $\alpha\ p'p\ t$ is a sub-string of S:

a. **T-Non-Informativity:** For all sentences D,

$\{w \in C \mid \text{for all } \beta:\ w \models \alpha\ [p'D]\ t\ \beta\} \subseteq \{w \in C \mid \text{for all } \beta:\ w \models \alpha\ D\ t\ \beta\}$[33]

[32] See also the discussion in chapters 3 (section 3.3.2.1) and 4 (section 4.3) for some variations on how to best understand the constraints that *Limited Symmetry* imposes.

[33] The brackets around $[p'D]$ are meant for exposition only, and should not be taken as part of the string.

b. **F-Non-Informativity:** For all sentences D,

$$\{w \in C \mid \text{for all } \beta: \; w \models \neg(\alpha \; [p'D] \; t \; \beta)\} \subseteq \{w \in C \mid \text{for all } \beta: \; w \models \neg(\alpha \; D \; t \; \beta)\}$$

These two constraints formalize the earlier intuitive characterization of non-informativity in terms of contextual equivalence independent of p and for all parsing points $\alpha \; p'p \; t$ after the parser encounters $p'p$ in S. They can be checked at every relevant parsing point $\alpha \; p'p \; t$, meaning that violations can be detected incrementally as the sentence is parsed from left to right. For example, in parsing ($p'p$ *and* q), comprehenders can try checking for violations at parsing points `(p'p`, `(p'p and`, and `(p'p and q`.

We now apply this kind of reasoning to the three cases most relevant for current purposes: ($p'p$ *and* q), (q *and* $p'p$), and ($p'p$ *or* q).

2.4.4.3. ($p'p$ *and* q)

For ($p'p$ *and* q), the constraint becomes operative at parsing point `(p'p`, where $t = \epsilon$, and we can start checking whether non-informativity holds at this and following parsing points:[34]

$t = \epsilon$**.** For `(p'p`, the sets on the left of both T-**N**(on)-**Inf**(ormativity) and F-**N**(on)-**Inf**(ormativity) yield the empty set: these are the sets of worlds where, for all D, ($[p'D] \; \beta$ and $\neg([p'D] \; \beta)$, respectively, are true for all β; but since β could be anything, including both `and` $\bot$ and `and` $\top$, no such worlds exist.[35] Since the empty set is a subset of any set, both constraints are vacuously satisfied.

[34] Note that our Non-Informativity constraints operate on *bracketed* strings, an assumption shared with Schlenker (2007), and Schlenker (2009). As pointed out by an anonymous reviewer, and our editor Yasu Sudo, this raises the question about what level of representation incremental approaches like *Limited Symmetry* and Local Contexts work on: is it pure linearized strings, or is there also some structure involved? And if there is structure involved, how does the parser know how much structure to attribute to a partial string, since in hearing $p'p$, there could be multiple possible parses, i.e. $p'p$, $(p'p$, $((p'p$ etc. Here, we make the assumption that as parsers are processing a linearized string from left-to-right, at every parsing point they follow a heuristic of attributing the *minimal* amount of structure that is consistent with the parse at that point. For example, in hearing $p'p$, they will posit only one opening parenthesis. If no binary connective follows $p'p$, then they will simply close the parenthesis and get $(p'p)$. Otherwise, if $p'p$ is followed by some binary connective $*$, they will continue working under the assumption that this is the highest connective, in which case they know that they should be expecting the final form of the sentence to be $(p'p * \delta)$. If afterwards they get information that makes them realise that this initial assumption was wrong (e.g. if it turns out that actually they are dealing with a sentence like $((p'p * q) * r))$, we assume that they will backtrack and restart the parsing process, positing more structure at the beginning, i.e. starting with assuming $((p'p$.

[35] More explicitly: Suppose the set of worlds such that ($[p'D] \; \beta$ is true for all β is non-empty. Then it contains a world $w \in C$ such that for any β, ($[p'D] \; \beta$ is true. But consider the case where β is of the form `and` $\bot$, where $\bot$ is a contradiction. The resulting sentence is not true in any world, hence it's not true in w. But this contradicts our

$t = and$**.** For `(p'p and`, we focus on the F-Non-Informativity constraint, which becomes:

(41) For all D: $\{w \in C \mid \text{for all } \beta : \; w \models \neg(([p'D] \; and \; \beta)\} \subseteq \{w \in C \mid \text{for all } \beta : \; w \models \neg((D \; and \; \beta)\}$

Since β can be anything, including $\top$), the left set consists of worlds where $p'D$ is false. The right set consists of worlds where D is false. So the constraint amounts to requiring that:

(42) For all D: $\{w \in C \mid p' = 0 \; or \; D = 0\} \subseteq \{w \in C \mid D = 0\}$

(42) holds iff $C \models p'$: suppose first that(42) holds. Then, since it holds for all D, it must hold for the case where D is a tautology $\top$, in which case the right set in (42) becomes the empty set. But then, (42) holds just in case $\{w \in C \mid p' = 0\}$ is empty, i.e. just in case $C \models p'$. For the converse, suppose that $C \models p'$. Then, the constraint in (42) can be re-written as the trivial:

(43) For all D: $\{w \in C \mid D = 0\} \subseteq \{w \in C \mid D = 0\}$

So $(p'p \; and \; q)$ violates the constraints unless p' is true in the context. In other words, it presupposes p' **no matter the second conjunct**, i.e. we always get projection and there's no right-to-left filtering.

2.4.4.4. $(q \; and \; p'p)$

For $(q \; and \; p'p)$, the constraints require that at the point `(q and p'p` it hold that:

(44) For all D:

T-**N-Inf**: $\{w \in C \mid \text{for all } \beta : \; w \models (q \; and \; [p'D] \; \beta\} \subseteq \{w \in C \mid \text{for all } \beta : \; w \models (q \; and \; D \; \beta\}$

assumption that w is a world where for all β, $([p'D] \; \beta$ is true. Hence $\{w \in C \mid \text{for all } \beta : \; w \models ([p'D] \; \beta\}$ must be empty. Parallel reasoning holds for $\{w \in C \mid \text{for all } \beta : \; w \models \neg([p'D] \; \beta)\}$, only this time take β to be `or` $\top$), where $\top$ is a tautology.

F-**N-Inf**: $\{w \in C \mid \text{for all } \beta: \; w \models \neg((q \; and \; [p'D] \; \beta)\} \subseteq$

$$\{w \in C \mid \text{for all } \beta: \; w \models \neg((q \; and \; D \; \beta)\}$$

The only possible β is '$)$', and $(q \; and \; [p'D])$ is true in worlds where p', D, and q are true. It's false in worlds where at least one of them is false. So, the constraints become:

(45) For all D:

T-**N-Inf**: $\{w \in C \mid p' = 1 \; and \; D = 1 \; and \; q = 1\} \subseteq \{w \in C \mid \; D = 1 \; and \; q = 1\}$

F-**N-Inf**: $\{w \in C \mid p' = 0 \; or \; D = 0 \; or \; q = 0\} \subseteq \{w \in C \mid D = 0 \; or \; q = 0\}$

T-Non-Informativity necessarily holds since the left set is more restrictive. F-Non-Informativity holds iff $q \models p'$: if F-Non-Informativity holds, then it holds for the case of $D = \perp$, with the constraint becoming:

(46) $\{w \in C \mid p' = 0 \; or \; q = 0\} \subseteq \{w \in C \mid q = 0\}$

This holds just in case all $\neg p'$-worlds in C are also $\neg q$-worlds, which in turn is equivalent to $C \models q \rightarrow p'$. Conversely, if $q \models p'$, then (47) holds (as there are no worlds where $p' = 0$ and $q = 1$), and F-Non-Informativity can be re-written as the trivial (48).

(47) $\{w \in C \mid p' = 0 \; or \; D = 0 \; or \; q = 0\} = \{w \in C \mid D = 0 \; or \; q = 0\}$

(48) for all D: $\{w \in C \mid D = 0 \; or \; q = 0\} \subseteq \{w \in C \mid D = 0 \; or \; q = 0\}$

Hence, a presupposition in the second conjunct places no constraints on the context as long as it is entailed by the first conjunct. We derive asymmetric filtering for conjunction.

2.4.4.5. $(p'p\ or\ q)$

For $S = (p'p\ or\ q)$, the parser encounters the presupposition at the point `(p'p`. Recall that the constraints must hold for all t such that $(p'p\ t$ is a sub-string of S. For this initial parse where $t = \epsilon$, the situation is exactly parallel to conjunction in 2.4.4.3 and the constraints hold vacuously.

$t = or$. For `(p'p or`, the constraints become:

(49) For all D:

T-**N-Inf**: $\{w \in C \mid \text{for all } \beta:\ w \models ([p'D]\ or\ \beta\} \subseteq \{w \in C \mid \text{for all } \beta:\ w \models (D\ or\ \beta\}$

F-**N-Inf**: $\{w \in C \mid \text{for all } \beta:\ w \models \neg(([p'D]\ or\ \beta)\} \subseteq \{w \in C \mid \text{for all } \beta:\ w \models \neg((D\ or\ \beta)\}$

Starting with the latter, the set of worlds where $([p'D]\ or\ \beta$ is false for all β is empty (since β can be $\top$), and F-Non-Informativity holds trivially (as the empty set is a subset of every set). For T-Non-Informativity, the left set of worlds consists of those where p' and D are true, and the constraint amounts to the straightforwardly true (50); thus, both constraints hold.

(50) For all D: $\{w \in C\ |p' = 1\ and\ D = 1\} \subseteq \{w \in C\ |D = 1\}$

$t = or\ q$. For the final relevant value of t, i.e,. the parse `(p'p or q`, we get:

(51) For all D:

T-**N-Inf**: $\{w \in C \mid \text{for all } \beta:\ w \models ([p'D]\ or\ q\ \beta\} \subseteq \{w \in C \mid \text{for all } \beta:\ w \models (D\ or\ q\ \beta\}$

F-**N-Inf**: $\{w \in C \mid \text{for all } \beta:\ w \models \neg([p'D]\ or\ q\ \beta)\} \subseteq \{w \in C \mid \text{for all } \beta:\ w \models \neg(D\ or\ q\ \beta)\}$

The only possible β is '`)`'. $([p'D]\ or\ q)$ is true in worlds where p' and D are true or where q is true (or all three), and T-Non-Informativity straightforwardly holds (as $\{w \in C \mid (p' = 1\ and\ D = 1)\ or\ q = 1\} \subseteq \{w \in C \mid D = 1\ or\ q = 1\}$). $([p'D]\ or\ q)$ is false in worlds where it both holds that either p' or D is false and q is false. It's useful to re-write this last set using the distributive law, with the F-Non-Informativity constraint becoming:

(52) For all D: $\{w \in C \mid (p' = 0 \textit{ and } q = 0) \textit{ or } (q = 0 \textit{ and } D = 0)\} \subseteq \{w \in C \mid q = 0 \textit{ and } D = 0\}$

This holds iff $C \models \neg q \rightarrow p'$: suppose first that (52) holds. Then it must hold for $D = \top$, in which case the right set becomes the empty set ($\top \neq 0$ in all w). But then the constraint can only hold if the left set is also empty, i.e., it must hold that $C \models \neg(\neg p' \textit{ and } \neg q)$, which is equivalent to $C \models \neg q \rightarrow p'$. Conversely, if $C \models \neg q \rightarrow p'$, then $\{w \in C \mid p' = 0 \textit{ and } q = 0\}$ is the empty set (there are no worlds where $\neg q = 1$ and $p' = 0$), and we can re-write (52) as (53), with subsethood trivially holding due to identity:

(53) For all D: $\{w \in C \mid q = 0 \textit{ and } D = 0\} \subseteq \{w \in C \mid q = 0 \textit{ and } D = 0\}$

Thus, we derived that a disjunction of the form ($p'p$ *or* q) requires that $C \models \neg q \rightarrow p'$, exactly the condition satisfied by 'bathroom' disjunctions. For a disjunction of the form (q *or* $p'p$), parallel reasoning derives the same condition, yielding symmetric filtering for presuppositions in disjunctions.

In sum, while we have to leave details of this theory and a more extensive discussion and evaluation for another occasion, we have shown that *Limited Symmetry* offers a Schlenker-inspired theory of projection where a single mechanism derives **asymmetric** conjunction and **symmetric** disjunction, on par with George's account but without a trivalent semantics.

2.5. Conclusion

In this chapter we have been concerned with the effect of linear order on presupposition projection in conjunctions and disjunctions. In two experimental studies, we find empirical evidence supporting the conclusion that they differ in this regard: whereas conjunction exhibits an asymmetry in projection, only allowing left-to-right filtering, disjunction was found to be symmetric, allowing filtering in either direction (without any cost for right-to-left filtering). These findings constrain theories of projection. In particular, they argue against theories that posit uniform effects of linear order on projection across connectives (cf. Schlenker 2009, Hirsch & Hackl 2014). Furthermore, theories like dynamic semantics, despite being powerful in allowing a lot (and arguably too much) freedom in the way projection rules are stated, cannot easily capture our data, as no single context change potential for disjunction derives symmetric filtering, and positing multiple CCP order variants just recreates versions of the explanatory challenge in light of the observed contrast between conjunction and disjunction. Trivalent accounts like that by George 2008b, with a general linear-order based algorithm for determining the distribution of undefinedness in truth-tables for connectives, capture the pattern successfully, but do require a commitment to a departure from classical bivalent semantics. Finally, the new *Limited Symmetry* account, first proposed in Kalomoiros 2021, 2022a, which follows Schlenker's proposal in its general approach, manages to combine a general and explanatory pragmatic account with an implementation that lets the projection mechanism interact with the truth conditions of a given connective, similar to George's account, thereby deriving varying impacts of linear order on projection for different connectives, in line with our experimental data. We see this as a fruitful new avenue for modeling projection, with many new questions and predictions to be explored in future work.

Chapter 3

Systems of (A-)symmetry

3.1. Introduction

This chapter represents an attempt to think about the (a-)symmetries of presupposition projection in a principled way. Three different systems are developed, each one providing a predictive criterion of when a sentence will allow presuppositions to be filtered by material that **comes after the trigger**. The basic empirical data point that all three systems are designed to capture is the asymmetric filtering profile of conjunction, contrasted to the symmetric filtering profile of disjunction:

(1) a. #Mary stopped smoking and she used to smoke ($\rightsquigarrow$ presupposes that Mary used to smoke)

b. ✓Mary used to smoke and she stopped smoking ($\rightsquigarrow$ presupposes nothing about Mary's smoking habits)

(2) a. ✓Either Mary stopped smoking or she never used to smoke ($\rightsquigarrow$ presupposes nothing about Mary's smoking habits)

b. ✓Either Mary never used to smoke or she stopped smoking($\rightsquigarrow$ presupposes nothing about Mary's smoking habits)

In (1a) there is an intuition that even though the second conjunct entails the information that Mary used to smoke, this 'comes too late' to satisfy the presupposition of 'stop' in the first conjunct. This contrasts with (1b) where information that Mary used to smoke is introduced before 'stop' and satisfies the relevant presupposition, (Karttunen, 1973; Stalnaker, 1974, a.o.). The crucial thing is that this pattern contrasts with the filtering in disjunctions, (2): there it seems that information either before or after 'stop' can be used to filter the presupposition, (Hausser, 1976; Soames, 1982; Schlenker, 2009, a.o.).

Presupposition filtering then appears asymmetric in conjunction (in that information after the trigger cannot be utilized), but symmetric in disjunction (in that information either before or after the trigger can contribute to filtering). Recent approaches to the (a-)symmetries of filtering, (Schlenker, 2008, 2009; Rothschild, 2011), have tried to maintain uniformity across connectives by assuming that both symmetric and asymmetric filtering are in principle available: asymmetric filtering is the processing default (facilitated by the left-to-right nature of incremental interpretation), while symmetric filtering is available at a processing cost (since the asymmetric default needs to be overridden).

Recent experimental evidence however, (Mandelkern et al., 2020, see also chapter 2), suggests that there is indeed a difference in the filtering profile of conjunction vs disjunction: symmetric filtering in disjunction appears much less costly than in conjunction. This cannot be accommodated within a framework where all filtering across connectives is underlyingly symmetric, with asymmetry being the default and symmetry being available at a cost, (Schlenker, 2008, 2009; Rothschild, 2011; Chemla & Schlenker, 2012, a.o.).

This situation becomes particularly interesting once considered against the background of 'explanatory' approaches to projection that aim for the following, (Schlenker, 2007; Schlenker, 2008, 2009):

(3) **Explanatory challenge:** Find an algorithm that predicts how any operator transmits presuppositions once its syntax and its classical semantics have been specified.

Current solutions to this explanatory problem involve a version of the 'default asymmetry, costly symmetry' idea introduced above, which nonetheless faces empirical challenges. Therefore, it becomes interesting to investigate if we can develop explanatory systems that meet the above challenge and which also handle filtering (a-)symmetries in a predictive way that corresponds more closely to the empirical picture as it is currently known.

The present chapter aims to do just that. Three different systems are developed, which produce asymmetric conjunction, but symmetric disjunction. The first two systems (dubbed *Limited Symmetry*) take their inspiration from Phillipe Schlenker's Transparency theory, (Schlenker, 2007; Schlenker, 2008), and aim to reformulate the Transparency intuitions in a way that derives the requisite (a-)symmetries. The difference between them is that *System 1* uses a fully bivalent logic as its semantic substratum, while *System 2* is based on a trivalent logic (the reasons for why one might want to make such a move are explained in section 4 and 5). The third system on the other hand, is based on a modification of dynamic semantics (Heim, 1983b) (as reconstructed by Rothschild 2011), and constrains dynamic semantics by introducing a truth conditional criterion as to which connectives update the context in an asymmetric vs symmetric way. Applying this criterion derives predictions about which connectives should show symmetry. Throughout the chapter, the three systems are contrasted along a 'test suite' of crucial cases that have been discussed in the literature on filtering asymmetries, with novel predictions pointed out along the way.

The rest of this chapter is organised as follows: Section 2 provides background on the architecture of some core theories of presupposition, focusing on two choice points that these theories bring to the fore: 1) should the core semantics be sensitive in some way to a presupposition dimension? 2) should the algorithm that derives the presuppositions of a sentence operate recursively on the compositional structure of a sentence or linearly on the linear representation of a string? Then, the empirical dimension of the (a-)symmetries debate is introduced, and an argument is made against the 'default asymmetry, costly symmetry view' on the basis of data from conjunction, disjunction, and conditionals. Section 3 introduces the core intuitions behind our three systems. Section 4 develops *System 1* of *Limited Symmetry*, while section 5 develops *System 2*. The dynamic system is presented in section 6. Section 7 compares our systems to the 'Disappointment' system of George 2008a,b, another attempt to predict symmetry for disjunction, but asymmetry for conjunction. Section 8 concludes.

3.2. Background

3.2.1. Filtering, projection and accommodation

The core task of any theory of presupposition is to give an algorithm predicting the presuppositions of a complex sentence from the presuppositions of it's parts. This is the so-called 'projection problem' for presupposition, (Langendoen & Savin, 1971; Karttunen, 1973, 1974; Gazdar, 1979; Karttunen & Peters, 1979; Heim, 1983b, among many others). For instance, presuppositions in the antecedent of a conditional become presuppositions of the conditional as a whole:

(4) a. **Context:** We have no idea if Buganda has a king.
b. #If the King of Buganda is bald, then he doesn't need to employ a barber.

The intuition about what goes wrong in a case like (4) is that the presupposition that there is a King of Buganda in the antecedent becomes a presupposition of the conditional as a whole (it projects), and hence comes into conflict with the stated ignorance in the context about the existence of a King of Buganda.

The reason an account of when a presupposition projects is needed is that it's not generally true that whenever some part of a sentence carries a presupposition, that presupposition becomes a presupposition of the whole sentence. This is exemplified for instance in (5):

(5) a. **Context:** We have no idea if Buganda has a king.
b. If Buganda has a king, then the King of Buganda is bald.

Here, the information in the antecedent can be used to satisfy the presupposition of the consequent. This phenomenon is known as 'filtering' (after Karttunen 1973): the presupposition of the consequent does not project to the global level, and thus causes no infelicity, despite the stated ignorance in the context about the existence of a King of Buganda.

Interestingly, filtering is not the only way that presuppositions 'disappear'. There are cases where a presupposition does not cause any infelicity, but at the same time there is no material in the sentence that can filter it. Consider the following:

(6) a. **Context:** I see Mary on the street, and she's looking very tired. I ask her what's going on.

b. Mary: I had to take my dog to the vet in the middle of the night.

In this case, even if I don't know that Mary has a dog, I'm unlikely to object, and say that I didn't know that Mary has a dog, despite her response presupposing it. In such cases, we say that the presupposition is **accommodated** (cf. Lewis 1979): the context is silently adjusted to entail the information that Mary has a dog. This use of accommodation is known as **global accommodation**, since I adjust my entire set of assumptions.

A different kind of accommodation is often invoked to explain examples like the following:

(7) There is no king of Buganda, therefore, it's not the case that the king of Buganda is bald.

The interest behind such cases lies in the fact that not only is there no material to filter the presupposition that Buganda has a king, but it's also the case that the context cannot be adjusted to include this information: we explicitly stated that there is no king of Buganda, so adding this to the context would lead to a contradiction. And yet the sentence doesn't suffer from presupposition failure. In these cases, the mechanism of **local accommodation** has been invoked to explain the absence of infelicity, Heim 1983b. The idea is that the presupposition is added locally (more details later in this section), below the scope of the negation, with the sentence essentially interpreted as:

(8) There is no King of Buganda, therefore, it's not the case that **(there is a King of Buganda and the King of Buganda)** is bald.

Local accommodation is taken to be a last resort option, that is dispreferred to global accommodation, and is costly, (Heim 1983b; Beaver & Krahmer 2001; von Fintel 2008; Chemla & Bott 2013; but see Siegel & Schwarz 2023 for recent evidence that on some dimensions local and global accommodation may be more on par than previously thought).

Theories of presupposition have generally kept the filtering dimension and the accommodation dimension distinct, with different mechanisms being responsible for each phenomenon.[36] The primary concern of the present study is the (a-)symmetries that arise with respect to **filtering**, i.e. the extent to which material that comes after some presupposition can be used to filter the presupposition of that trigger. Therefore, the emphasis is on filtering mechanisms rather than accommodation. At the same time, there is always the possibility that what looks like symmetric filtering might actually be the result of local accommodation (Schlenker 2008; Hirsch & Hackl 2014). With the above in mind, this section has two aims: first to present a variety of theories of filtering, and isolate the dimensions of variation between them in preparation for the presentation of our own approaches

[36] There at least two examples of theories that have moved away from the filtering vs accommodation dichotomy. Both of them involve some suspicion around the idea of filtering. Gazdar 1979 (see also van der Sandt 1982) took cases where a presupposition does not project to be explained by *cancellation*, essentially rejecting the notion of filtering. The idea was that initially, all the component presuppositions of a sentence S are *potential* presuppositions. Roughly speaking, of the potential presuppositions, only those that don't conflict with the speaker's assumptions (i.e. their context), other parts of the meaning of S, or with the scalar implicatures that S gives rise to project and become actual presuppositions of S. The rest get cancelled. There is an obvious sense that cancellation has parts in common with local accommodation, as they are both motivated by a presupposition not being projected so that contradictions are avoided. The criticisms of Gazdar 1979 are well-known (Soames, 1982; Heim, 1983b, see also Beaver 2001for discussion). They famously involve cases where a potential presupposition of a sentence doesn't conflict with anything, and yet no presupposition is observed.

More recently, Simons et al. 2010; Beaver et al. 2017 have pursued a view that tries to unify various 'projective' parts of meaning (i.e. presuppositions, non-restrictive relatives etc). The idea is that the parts of the meaning of a sentence that project are the parts of the meaning that **not backgrounded**, where *backgroundedness* is defined (roughly) by whether a certain part of the meaning addresses the QUD, (Roberts, 2012). Again, in this kind of approach filtering is not really recognized as a phenomenon distinct from accommodation; rather, cases of filtering must be seen as some kind of accommodation (triggered, for instance, by the fact that projecting the presupposition would lead to something implausible given a speaker's assumptions, (Roberts & Simons, 2022)). I will not provide a detailed criticism of these views here, as it falls outside the scope of the current chapter (but see Peters 2016; Djärv & Bacovcin 2020; Siegel & Schwarz 2023). Nevertheless, if indeed filtering is reducible to some kind of accommodation, then there is a clear empirical question to be asked: in environments where global accommodation is not allowed, does it hold that cases of purported filtering parallel cases of uncontroversial local accommodation? Recall from Experiment 2 in chapter 2 that PsSecond disjunctions were always higher in acceptability than EISimplePs conditionals. On the view that both PsSecond and EISimplePs involve local accommodation, this difference is unexpected. But on a view where PsSecond shows standard costless filtering, whereas EISimplePs shows costly local accommodation, this is expected (thanks to Florian Schwarz (pc) for bringing this point to my attention). Given this, I still think that filtering has a role to play in our theories of presupposition. As a result, in this chapter I focus on theories that make the filtering vs accommodation distinction.

later. Second, to discuss the empirical landscape regarding filtering (a-)symmetries in order to make the case that the default filtering behavior of some connectives is asymmetrical, whereas the default filtering behavior of other connectives is symmetric, and that the latter happens in ways that cannot be attributed to local accommodation.

3.2.2. (A-)symmetries: The architecture of presupposition

3.2.2.1. Semantic approaches

Basics The semantic approach to presupposition takes it to be a relation between sentences, (Strawson, 1950):

(9) **Strawsonian presupposition (adapted from Beaver 1997):** A sentence ϕ presupposes a sentence ψ iff ψ is entailed by both ϕ and $\neg\phi$.

This kind of approach is usually cashed out in the context of a trivalent logic where sentences can be true, false or # (undefined), (Bochvar, 1939; Kleene, 1952; Gamut, 1991).[37] For a sentence to have a classical truth value, its presupposition needs to be true. If the presupposition is false, then the sentence (and its negation) are undefined. Thus, whenever a sentence or its negation are true, the presupposition is true.

Strong Kleene For atomic sentences, the presuppositions are taken to be a matter of lexical convention (cf. Karttunen & Peters 1979). In complex sentences, the way the undefinedness of atomic sentences percolates up the structure is specified via truth tables. While these can just be stipulated, explanatorily it's obviously better if they derive from some kind of intuitively grounded algorithm. One of the algorithms that comes closest to capturing the basic landscape of projection phenomena is the so-called Strong Kleene algorithm, (see among others Kleene 1952; Gamut 1991; George 2008a) based on the following simple intuition: if we have a sentence that carries a presupposition, but in some world w we can ignore this presupposition and assign a truth value

[37]The method of supervalutions, (van Fraassen, 1971, 1969) has a lot in common with Strong Kleene. Since supervaluations essentially keep the symmetry of Strong Kleene for the cases that are of interest to us, we omit an explicit discussion in order to save some space.

to the sentence on the basis of its non-presuppositional components following the rules of classical logic, then we do so.[38] If we cannot, then the sentence suffers from presupposition failure and is undefined.

(10) **Strong Kleene:** A complex sentence S has a classical truth value if one can be determined on the basis of the classical truth table for S. It is undefined otherwise.

This leads to the following definedness truth tables for the connectives (ignore table 3.5 for the moment):

p	$\neg p$
T	F
F	T
$\#$	$\#$

Table 3.1: Trivalent negation

$p \wedge q$	T	F	$\#$
T	T	F	$\#$
F	F	F	F
$\#$	$\#$	F	$\#$

Table 3.2: Symmetric trivalent conjunction

$p \vee q$	T	F	$\#$
T	T	T	T
F	T	F	$\#$
$\#$	T	$\#$	$\#$

Table 3.3: Symmetric trivalent disjunction

$p \rightarrow q$	T	F	$\#$
T	T	F	$\#$
F	T	T	T
$\#$	T	$\#$	$\#$

Table 3.4: Symmetric trivalent conditional

p	$A(p)$
T	T
F	F
$\#$	F

Table 3.5: Accommodation operator

In this kind of system, a complex sentence p presupposes whatever needs to hold so that p is not undefined. Let $Pr(p)$ be the sentence (if it exists) that is true iff p is defined. Think of $Pr(p)$ as the sentence expressing the presuppositions of p. We can then state the following rules:

- A negation $\neg p$ is defined iff p is defined iff $Pr(p)$ is true.
    - $Pr(\neg p) = Pr(p)$
- A conjunction $p \wedge q$ is defined iff whenever p is undefined, then q is false, and whenever q is undefined, then p is false: i.e., whenever $\neg Pr(p)$ is true, then q is false, which is equivalent to

[38] The idea of ignoring a presupposition will come back later even more forcefully in the context of *Transparency*.

$q \to Pr(p)$. And whenever $\neg Pr(q)$ is true, then p is false, which is equivalent to $p \to Pr(q)$.

  - $Pr(p \wedge q) = (q \to Pr(p)) \wedge (p \to Pr(q))$

- A disjunction $p \vee q$ is defined iff whenever p is undefined q is true, and whenever q is undefined p is true: i.e., whenever $\neg Pr(p)$ is true, then q is true, which is equivalent to $\neg q \to Pr(p)$. And whenever $\neg Pr(q)$ is true, then p is true, which is equivalent to $\neg p \to Pr(q)$.

  - $Pr(p \vee q) = (\neg q \to Pr(p)) \wedge (\neg p \to Pr(q))$

- A conditional is defined iff whenever p is undefined, then q is true, and whenever q is undefined, then p is false: i.e., whenever $\neg Pr(p)$ is true, then q is true, which is equivalent to $\neg q \to Pr(p)$. And whenever $\neg Pr(q)$ is true, then p is false, which is equivalent to $p \to Pr(q)$.

  - $Pr(p \to q) = (\neg q \to Pr(p)) \wedge (p \to Pr(q))$

Note the symmetry: a presupposition in the first argument of a connective can be filtered as long as the second argument has the right entailments; and similarly, a presupposition in the second argument can be filtered by the entailments of the first argument.

Accommodation The way trivalent theories handle accommodation phenomena is via the A-operator, (see table 3.5). It applies to a trivalent formula, leaving classical truth values unchanged, but mapping undefinedness to falsity. The operator works by applying to a sentence p and producing a sentence $A(p)$ whose semantics are equivalent to the conjunction of p with p's presuppositions (cf. the discussion of local accommodation earlier). Thus, if the either p or the presuppositions of p are false, then $A(p)$ is false; it's true iff both p and its presuppositions are true.

If A applies to the top level of a sentence its effects are akin to global accommodation; if it applies locally, under the scope of some operator, it can be thought of as locally accommodating a presupposition under the scope of that operator.[39]

[39] Given that in a purely semantic theory of presupposition no reference is made to contexts, the terms 'global' and 'local' accommodation are slightly abused here, since 'accommodation' usually is taken to mean 'accommodation in some context'. All that I mean here is that applying the A-operator has the effect of canceling presuppositions either at a global or local level in the sentence. Of course, any account of A-insertion will need to be constrained via some reference to pragmatic factors, and contexts will reappear then.

(A-)symmetries Given the fully symmetric nature of this approach, how are asymmetries handled? In keeping with the intuition that asymmetries are an effect of left-to-right processing, one strategy is to restrict the Strong Kleene intuition on the basis of order: when getting the first argument of a truth functor, we have no access to the second argument (because of left-to-right processing), so we check if the truth value of the first argument in a given world is enough to determine the truth value of the whole sentence in that world. If it is, then the whole sentence receives that truth value. If it isn't, then things depend on whether the truth value of the first argument is classical: if yes, then proceed to the truth value of the second argument (there is no reason to suspect any kind of undefinedness yet); but if the first argument is undefined, then it's game over: the whole sentence is undefined. This produces the so-called Middle Kleene system (see Krahmer 1994; George 2008a) where undefinedness of the first argument is automatically projected to the global level, regardless of the second argument. Conversely, undefinedness in the second argument is dealt with via the standard Strong Kleene recipe.

To the extent that one wants access to both symmetry and asymmetry, an intuitive route would be to take the Middle Kleene system as the default, since it can plausibly be seen to derive from linear order considerations, but also allow access to the Strong Kleene system at a processing cost. This would follow essentially Schlenker's strategy (see below), of positing two mechanisms, one asymmetric, the other symmetric, and taking the asymmetric one to be the default. Note also that the effects of this move **do not** depend on the connective: any connective should in principle have a default asymmetric interpretation, alongside a costly symmetric one.

Another way to introduce incrementality considerations in a trivalent system will be briefly reviewed in the context of the Transparency theory (see section 3.2.2.3), as it is essentially involves applying the insights of that account to expressions that are interpreted in a Strong Kleene logic. We now turn to pragmatic approaches to presupposition.

3.2.2.2. Pragmatic approaches

Basics The semantic approach reviewed above takes presupposition failure to produce semantic undefinedness. Pragmatic approaches instead look at presupposition as what needs to be satisfied by a *context* for a sentence to be integrated into it. They take as their underlying framework the idea that communication consists of interlocutors exchanging information against a context of background assumptions. Interlocutors put forth propositions for integration into the context, and these propositions can be accepted or rejected. But some sentences come with preconditions that need to be satisfied before they can be accepted into the context. Presuppositions are precisely these conditions that a context needs to satisfy for a sentence to be integrated into it (Stalnaker, 1974; Karttunen, 1974). If these conditions are not satisfied, this doesn't necessarily mean that the sentence itself is semantically undefined. However, it does mean that the sentence cannot be integrated into the context (at least not without some accommodation process). In this way, the semantics need not encode information about the presuppositions of sentences; the underlying logic might as well be taken to be classical bivalent logic, with all presupposition-related phenomena being handled in the pragmatics of context-integration.

Filtering rules In this kind of approach, the conditions that atomic sentences need to satisfy to be integrated in a context are assumed to be known (either as a matter of conventionalized knowledge or as the result of some triggering algorithm, Stalnaker 1974; Simons 2001; Abrusán 2011; Schlenker 2021). For example, if 'John stopped smoking' is to be admitted into a context C, C must entail that 'John used to smoke'. Taking contexts to be a set of possible worlds (representing the things taken for granted between participants in a discourse), (Stalnaker, 1978), then every possible world in the set must make this proposition true. This leads to the following notion of presupposition:

(11) **Pragmatic presupposition:** An (atomic) sentence ϕ presupposes a sentence ψ in a context C iff $C \models \psi$ whenever C admits ϕ.

Following Karttunen 1974, one can specify recursive rules for complex sentences that determine the admissibility of a sentence in the context from the admissibility of its parts. For instance, the rules for negation and conjunction could look as follows:

(12) a. $\neg A$ is admitted in C iff A is admitted in C

b. $(A \wedge B)$ is admitted in C iff A is admitted in C and B is admitted in $C \cap I(A)$

The presuppositions (admissibility conditions) of $\neg A$ are just those of A (so presuppositions project from negation), where as the presuppositions of $(A \wedge B)$ are the presuppositions of A and the presuppositions of B that are not entailed by $C \cap I(A)$.[40] Therefore, if the context entails all the presuppositions of A and the context together with A entails all the presuppositions of B the sentence will be admitted. These are essentially asymmetric filtering conditions for a conjunction.

Even though the conjunction rule in (12b) produces left-to-right asymmetry, as noticed by Rooth in a letter to Heim and Soames 1989, we could have written a rule that produces right-to-left asymmetry:

(13) $(A \wedge B)$ is admitted in C iff B is admitted in C and A is admitted in $C \cap I(B)$

And nothing prevents us from taking the filtering rule for $(A \wedge B)$ to be the disjunction of (12b) and (13):[41]

(14) $(A \wedge B)$ is admitted in C iff A is admitted in C and B is admitted in $C \cap I(A)$ OR B is admitted in C and A is admitted in $C \cap I(B)$

In a case where A is carrying a presupposition and B is presupposition-less, but entails the presuppositions of A, then according to (14) the whole sentence can be admitted in C. In other words the presupposition of A is filtered. Parallel reasoning derives that in a case where B carries a presupposition that is entailed by a presupposition-less A, the presupposition of B is filtered.[42] The

[40] We take sentences to denote sets of possible worlds so that we can intersect them with a context. I(A) is the denotation of A, defined as a function from sentences to worlds where the sentence is true in the usual way.

[41] This move is reminiscent of Rothschild (2011)'s reconstruction of dynamic semantics, see below.

[42] It is interesting to consider the case of a conjunction where both A and B carry a presupposition. According to the rule in (14) the context C must at least entail either the presupposition of A or the presupposition of B. If this doesn't happen, then neither disjunct in (14) is true, and the sentence is not admitted. This sets the system apart from Strong Kleene (even though there are obvious similarities between the two). Consider a context where in every

question of course is why these rules and not others. The Strong Kleene system was based on a very simple underlying intuition. Is there something parallel for admissibility rules of this kind?

Constraining filtering Two factors have been proposed to constrain filtering rules: linear order and truth conditions. Stalnaker 1974 argued that the rule in (12b) derives from linear order considerations that are inherent in communication: in hearing a conjunction $(A \wedge B)$ in a conversation, we get access to the left conjunct A first; since a conjunction asserts both of it's conjuncts, the first conjunct can integrated into the context, i.e. non-A worlds can be eliminated. Subsequently, we get access to the right conjunct B, which is integrated into a context that has already been updated with A. While this type of reasoning is readily available for conjunction, it proved harder to generalize to other connectives (a disjunction does not assert either of its disjuncts), and to quantifiers.

Truth conditions Heim 1983b took the truth-conditions route, claiming that the resulting filtering rules should derive from the truth conditions of the connectives. This was formalized within the framework of dynamic semantics where the meaning of a sentence is an instruction to update the context. In this framework, the way a connective interacts with the context is lexicalized into the semantics of the connective itself (rather than derived from conversational reasoning).[43] For example the meaning of conjunction $(A \wedge B)$ is to update the context C first with A and then update the result of that with B:[44]

(15) $C + (A \wedge B) = (C \cap \{w \mid \text{A is true in w}\}) \cap \{w \mid \text{B is true in w}\}$

The idea is that such updates need to be truth-conditionally adequate in the sense that after the end of the update, all the worlds left in the context must support (the classical meaning of) $(A \wedge B)$ (see also Rothschild 2011 and section 6). An update is defined iff all of its component updates are

world either the presuppositions of A are true, or the presuppositions of B are true, but not both. As long as all worlds that make the presuppositions of A false, make B false, and all the worlds that make the presuppositions of B true make A false, then the sentence will be defined in all worlds in C. Hence, no presupposition failure occurs. But in such a case the rule in (14) is not satisfied.

[43] For this reason, Heim's appraoch is typically seen as a semantic (instead of pragmatic) approach to presupposition. Here we present it in the context of Karttunen's account to emphasize the continuity of intuitions between the two approaches, despite the differences in implementation.

[44] Following Heim 1983b, the $C + S$ sequence is to be understood as 'context C is incremented with sentence S'.

defined, so in the conjunction case, the update of C with A must be defined (which will be the case just in case A is admissible in C in the sense discussed above), and B is admissible in $C \cap [\![A]\!]$. This produces the asymmetric filtering conditions in (12b).

This approach represented groundbreaking progress in getting filtering conditions to follow from truth conditions; however it faced an obstacle of explanatoriness in that truth conditions did not determine **unique** update rules for connectives, (Rooth in a letter to Heim; Soames 1989; Heim 1990). This last feature meant that one could still not distinguish between updates that produce asymmetric vs symmetric filtering rules. For instance, it's possible to come up with a truth-conditionally adequate update for conjunction that produces symmetric filtering. The trick (following essentially Rothschild (2011)) is to disjoin various truth-conditionally adequate update rules, that update the context either right-to-left or left-to-right.

(16) $C+(A \wedge B) = (C \cap \{w \mid \text{A is true in w}\}) \cap \{w \mid \text{B is true in w}\}$ OR $(C \cap \{w \mid \text{B is true in w}\}) \cap \{w \mid \text{A is true in w}\}$

This rule says that a conjunction can update the context either with the left conjunct conjunct first and the right conjunct second, or vice versa. In this way, this rule is truth conditionally equivalent to the rule in (15): at the end, only worlds where both A and B are true are left in the context. However, the filtering condition that follows from it is exactly the filtering condition in (14).

(17) $(A \wedge B)$ is defined iff updating C with A is defined and updating $C \cap [\![A]\!]$ with B is defined OR updating C with B is defined and updating $C \cap [\![B]\!]$ with A is defined.

Therefore, relying only on truth conditions does not lead to a unique specification of filtering rules in dynamic semantics. Can recourse to a notion of order remedy that?

Order The idea of considering multiple truth-conditionally adequate updates at once that was introduced above can be pushed further. Rothschild (2011) shows how by considering all truth-conditionally adequate updates that satisfy certain constraints, one can construct a version of dynamic semantics that is symmetric across the board in an explanatory way (see section 3.6 for more details). As Rothschild (2011) shows, such a system can be constrained on the basis of **order** to derive fully asymmetric definendness conditions. Simply prohibit update rules where the second argument of the connective is involved in some update of the context before the first argument (I'm simplifying here; see the original for the details). Like Middle Kleene, this move produces a fully asymmetric system out of a fully symmetric system. And again, if we want symmetry to be constrained, we can take the asymmetric version as default (with symmetry being accessible at a cost); the move is the same as before, making no distinctions in terms of the (a-)symmetry behavior of each connective.

Accommodation In this kind of approach where sentences get progressively integrated into a context, we can talk about accommodation of a sentence's presuppositions in a context. If the presuppositions of a sentence is added to the original global context, then we talk about global accommodation. On the other hand, this kind of approach also gives access to intermediate contexts as integration of the sentence occurs; for instance, a conjunction first involves integrating the left conjunct producing an intermediate/ local context $C \cap [\![A]\!]$. If we add a presupposition to one of these local contexts, then we talk about local accommodation (compare with the uses of the A operator in trivalent systems above).

Integrations Note that what we presented here as semantic vs pragmatic approaches to presupposition are not in general incompatible. One can state the following principle, known as *Stalnaker's Bridge*, (Stalnaker, 1978), that connects trivalent sentences to admissibility in a context C:

(18) ***Stalanker's Bridge*:** A trivalent sentence S can update a context C iff S receives a classical truth value in every world in C.

Now one can identify the sentence that needs to hold so that S is not undefined with the information that needs to be entailed by C so that S be admissible in C. In fact some notion of context has to be injected into trivalent theories, if only to regulate the appearance of the A-operator (if this operator is to be construed as an accommodation operator that is pragmatically constrained). It could also be perfectly possible that failure of some presupposition can cause undefinedness of a sentence S in a world w, and that this is something that people take into account when trying to integrate a sentence into the context (for one early view on the conversational dynamics that result from trying to integrate trivalent sentences into a context see Seuren 1988). In fact, even though both of the systems that we will develop later rest on a pragmatic notion of presupposition, the second system does take a version of the Strong Kleene logic as its semantic basis, and attempts to constrain it by considering how interlocutors might reason about integrating such sentences in a context. But before turning to that, we need to introduce the core notion that will underlie our projection systems, that of *Transparency*.

3.2.2.3. The Transparency Intuition

Intuitions and assumptions Transparency was introduced in a series of papers by Phillipe Schlenker (Schlenker, 2007; Schlenker, 2008) and represents a major step towards an explanatory account of projection. The core idea derives from the following observation: in a Heimian dynamic semantics, if we can update context C with a sentence S, then any presuppositional expression in S can be ignored (in the sense that any infomration it adds is already present).

To see an example of this, assume we can represent atomic presuppositional expressions with a formula of the form $p'p$ where p' is the presupposition and p is the assertion. Updating a context with $p'p$ is defined iff $C \models p'$. If defined, the update of C with $p'p$ consists of leaving in C only the worlds that are both p' and p. Note that when the update is defined, the presupposition p' plays no role; we could have just as well updated C with p and the result would have been the same, since all the worlds in C are p' worlds. This is a more general property of a projection system based on a dynamic semantics: if updating with a sentence S that contains an atomic expression of the form $p'p$ is successful, then the result is the same as updating in the same context with the version of S where $p'p$ has been replaced with p (see Schlenker 2007 for the details). In a very direct way, this expresses the idea that presuppositional information is information that we can take for granted

(Stalnaker, 1974) and hence simply ignore.

Mechanics Schlenker argued convincingly that we can get a more explanatory/predictive theory by taking the idea that a sentence with an atomic $p'p$ component should have the same semantics as the version of the sentence with $p'p$ replaced by p as primitive and derive a projection system from it (instead of having this be a consequence of an independently defined projection system like Heim's dynamic entries). This is dubbed the principle of Transparency and can be stated as follows:

(19) **Transparency (adapted from Schlenker 2007:** A sentence $S = \alpha\ p'p\ d$ is acceptable in a context C just in case the following holds:

- $\forall p : C \models \alpha\ p'p\ d \leftrightarrow \alpha\ p\ d$

This is meant to be embedded in a pragmatic theory of presupposition: a sentence presupposes whatever needs to hold in a context so that Transparency holds for it. Moreover, the theory doesn't require dynamic entries. It can be stated on top of a classical bivalent logic (where conjunction and disjunction are commutative, and hence symmetric), and it will derive filtering conditions (see below). As it stands, the principle above produces a symmetric projection system, as we can look at the whole of S in deciding whether we can substitute its $p'p$ part with p salva veritate in C.

An example As above, take $p'p$ to be a sentence with a presuppositional component p' and an assertive component p. However, now $p'p$ is interpreted as a fully classical conjunction: it is true in a world w iff p' is true and p is true. Consider now a sentence of the form $(p'p\ and\ q)$. Transparency requires that:

(20) $\forall p :\ C \models (p'p\ and\ q) \leftrightarrow (p\ and\ q)$

This holds just in case $C \models q \to p'$. To see this suppose that the Transparency condition in (20) holds. Since it holds for all p, it holds for $p = \top$, where $\top$ is a tautology. Then we have:

(21) $C \models (p'\top\ and\ q) \leftrightarrow (\top\ and\ q)$, which holds just in case $C \models (p'\ and\ q) \leftrightarrow q$

This last condition holds just in case $C \models q \rightarrow p'$, so as long as in a context C the second conjunct entails the presupposition of the first, the sentence is acceptable in C. Conversely, if one assumes that a context $C \models q \rightarrow p'$, one can show that (21) holds.

Asymmetry The theory can be made asymmetric, by requiring that Transparency be established as soon as one encounters the presuppositional component $p'p$ no matter what might follow. This is done via the following definition:

(22) **Asymmetric Transparency:** A sentence S that begins with a a string of the form $\alpha\ p'p$ is acceptable in a context C just in case for every good final β, the following holds:

- $\forall p : C \models \alpha\ p'p\ \beta \leftrightarrow \alpha\ p\ \beta$

The core novel bit now is that Transparency is required to hold as soon as the comprehender encounters $p'p$ for all good finals β (where a good final is a string that represents a completion of S that produces a well-formed formula), i.e. no matter how S ends. For example, with a sentence $S = (p'p\ and\ q)$, Transparency must hold at the `(p'p` point no matter how the sentence ends. This means that Transparency must hold even for a completion like `and` $\top$), which would lead to the following condition:

(23) $\forall p : C \models p'p \leftrightarrow p$

This holds just in case $C \models p'$. On the other hand, if we consider $(q\ and\ p'p)$, then the condition that we derive is that asymmetric Transparency holds just in case $C \models q \rightarrow p'$ (the reasoning is quite similar to the symmetric Transparency case in (21)). This way of making Transparency asymmetric makes no distinction between the connectives: it doesn't matter if $p'p$ appears as a first conjunct, a first disjunct or in the antecedent of a conditional. All these cases work as above. Again, to accommodate symmetry one can take the asymmetric definition as default, and postulate that access to the symmetric definition is allowed at a cost. This leads to asymmetry being the default across all connectives, with symmetry being uniformly available at a cost.

Incrementalized Strong Kleene The restriction to bivalence assumed by Schlenker 2007 is not a necessary feature of Transparency. One can assume a language that is interpreted in a trivalent logic that is underlyingly symmetric with respect to its filtering properties, as in the case of Strong Kleene above, and then apply a Transparency-like constraint by quantifying over good finals (see Fox 2008; Chemla & Schlenker 2012):

(24) **Incrementalized Strong Kleene:** A sentence $S = \alpha\ p'p\ \beta$ is acceptable in a context C just in case for all β that do not contain any primed sentences, $\alpha\ p'p\ \beta$ receives a value that is not # in all worlds in C, according to the Strong Kleene algorithm.[45]

For example, $(p'p \wedge q)$ is acceptable just in case $C \models p'$. To see this, suppose first that $(p'p \wedge q)$ is acceptable in C according to the definition in (24). Suppose for a contradiction that $C \not\models p'$. Choose a $w \in C$ such that $p' = 0$. In that w, Strong Kleene assigns $(p'p \wedge \top)$ the # value: $p'p$ is #, while $\top$ is true. Therefore, $(p'p \wedge q)$ is not acceptable in C, since for $\beta = \wedge\top)$, $(p'p\beta$ is # in w. But this is a contradiction. Therefore, $C \models p'$. For the other direction, if $C \models p'$, then the first conjunct will never be undefined in a world in C. We need to show that for any β (where β does not contain material that can receive the # value), $(p'p\ \beta$ is never #. Since $p'p$ is always defined in C and β contains no material that can lead to undefinedness, this clearly holds.

The same argument applies to $(p'p \vee q)$, deriving that it presupposes $C \models p'$. For a conditional, if we represent it as $(if\ p'p.\ q)$, it suffices to consider $\beta = \wedge\ \bot)$ to derive the same result.

With regards to (a-)symmetries, we can then make a parallel move as above and claim that incrementalized Strong Kleene is a default rooted in incremental interpretation, with Strong Kleene

[45]The restriction to β that do not contain primed sentences is there so that a possible completion will not cause the sentence to be undefined.

being accessible at a processing cost (currently incrementalized Strong Kleene and Middle Kleene might appear all too similar; they are not. See section 2.2.3 for some differences between them).

Local Contexts It is worth noting that another way of cashing out the Transparency intuition is to consider what is the strongest transparent expression r that one can conjoin to a constituent E. In a sense this asks for the strongest thing that can be presupposed in the context of a constituent E without leading to a violation of Transparency. Therefore, if a constituent E carries a presupposition p' that is not entailed by this strongest Transparent restriction r, then the presupposition leads to unacceptability in C.

Schlenker 2009 calls this r the **local context** of E (in a nod towards the idea of local context in the Karttunen-Heim dynamic tradition), and shows how it can be identified with the part of the context where the truth value of the sentence that carries E is not yet determined. In other words the local context is the part of C that a comprehender cannot ignore, as the truth value of S is not fixed in it. For example, the local context of a second conjunct consists of all the worlds in C where the first conjunct is true, as in the subset of C where the first conjunct is false, the sentence is already false, regardless of the truth value of the second conjunct. Depending on whether one uses a symmetric or asymmetric definition of Transparency, one gets a symmetric or asymmetric local context. The idea that comprehenders reason about the subsets of the context where a sentence has an (un)determined truth value will be crucial to the development of *Limited Symmetry* later.

Accommodation In Transparency theory, global accommodation consists (as usual) in adding information to the global context C. Local accommodation is trickier. The theory doesn't give access to intermediate 'local' contexts that result from successive updates while integrating a sentence S in the context. Schlenker 2007 suggests that one way to model the effects of local accommodation in Transparency is to assume that for a given $p'p$ in S, comprehenders can choose to not apply the Transparency constraint to it. Writing $S(\phi)$ to refer to a sentence S that contains ϕ as one of its sub-formulas, this understanding of local accommodation can be thought of essentially treating $S(p'p)$ as $S(p' \textit{ and } p)$. Presumably this would come at a cost, which would be congruent with the fact that local accommodation is thought of as a dispreferred option.

3.2.2.4. Dimensions of theoretical variation

Summarizing the theoretical playing field so far, we can categorize the approaches along the following dimensions:

- Is the compositional semantics sensitive to a dimension of presupposition?
- Does the algorithm that derives whether a sentence suffers presupposition failure operate recursively on some structural level of representation of the sentence, or 'more globally' on a linear representation of the sentence?

Trivalent approaches clearly semanticize presupposition, since presupposition failure is represented by a distinct truth value. The Strong Kleene algorithm operates recursively on the structure of a sentence to derive the cases of undefinedness of a given complex sentence from the cases of undefinedness of the arguments that make it up. Interestingly, the Middle Kleene algorithm while operating recursively by taking subparts of a sentence as input, does make reference to a notion of order: a sentence always returns # if its first argument is #, where an argument is 'first' on some linear ordering of the arguments of the sentence.

An approach based on filtering rules (Karttunen, 1974) on the other hand starts from a more pragmatic notion of presupposition, and as such can assume a bivalent semantics. However, the algorithm that applies to determine whether a sentence is admissible in a context operates recursively on the sentence. The compositionality inherent in this kind of 'admissibility checking' is what allows the idea to be transferred to fully semantic setting in the case of dynamic semantics, which arguably represents an instance where the semantics *qua* update instructions is sensitive to presupposition (updates are undefined when presuppositions fail), and the whole algorithm applies recursively on the arguments of a complex sentence.

From the point of view of the theoretical typology we are developing, the Transparency approach does represent a break, in that the semantics is wholly insensitive to presupposition (presuppositions are treated as regular entailments in the semantics), and the algorithm that determines whether or not a sentence suffers presupposition failure applies to *strings*, without making reference to the compositional structure of said strings.[46]

Finally, the version of incrementalized Strong Kleene we considered above represents an interesting amalgam, in that the semantics were sensitive to presupposition, but the constraint that incrementalized it was stated globally on strings (in contrast to the more 'structural' Middle Kleene approach).

3.2.3. (A-)symmetries: The empirical picture

So far, we have seen that theories of projection have taken an all-or-nothing approach to the issue of (a-)symmetries: all connectives are predicted to be default asymmetric, with symmetry being available at a cost. Here we summarize the currently known state of empirical evidence on the issue, which strongly points to a more nuanced picture: for some connectives symmetry seems available without a cost under certain circumstances, whereas for others asymmetry seems very hard to overcome (see also chapter 2).

3.2.3.1. Conjunction

Preliminaries The core conjunction contrast, as alluded to in the introduction, begins with examples of the following type:

(25) a. **Context:** We have no knowledge of Mary's smoking habits
 b. ✗Mary stopped smoking and she used to smoke.
 c. ✓Mary used to smoke and she stopped.

While it's data like this that initially led theorists to posit that presupposition projection from conjunction is asymmetric, it was pointed out by Schlenker (2008) (see also Rothschild 2011; in some form, the point even goes back to Karttunen 1973) that examples like (25b) suffer from a confound: if we take the sentence "Mary stopped smoking" to entail that "Mary used to smoke"

[46] Although structure is not wholly absent, since the strings contain parentheses. The point is that the algorithm is not stated *recursively*.

(in the sense that every time the first sentence is true, the second sentence is also true), then in (25b) “Mary stopped smoking" is followed by one of its entailments. But such sentences produce a redundancy violation and are odd even when no presuppositions are involved, (26a). Conversely, when the entailed sentence precedes its “entailer”, then no infelicity arises, (26b).

(26) a. ✗Mary is in Paris and she is in France.
b. ✓Mary is in France and she is in Paris.

Therefore, it could be the case that the infelicity observed in (25b) is not due to the presupposition of ‘stop’ projecting and coming into conflict with the ignorance about Mary’s smoking habits stated in the context, but rather is an instance of a redundancy violation. And indeed, it seems that removing the entailment between the two conjuncts, improves things:

(27) a. **Context:** We have no knowledge of Mary’s smoking habits
b. Mary stopped smoking and she used to smoke Marlboros.
c. ✓Mary used to smoke Marlboros and she stopped smoking.

Another kind of case in the same vein, considered in Rothschild 2008, takes the following form:

(28) a. If John doesn’t know that it’s raining, and it’s raining, then ...

The idea here is that negating a presuppositional conjunct means that its presuppositions are no longer entailed (at least on a bivalent understanding of the presuppositional component). Therefore, this represents another way of getting rid of the redundancy confound. Rothschild reports a judgment whereby (28) carries no presupposition.

(29) If John doesn’t know it’s raining and it is raining, then John will be surprised when he

walks outside.

In the same vein he also considers the following:

(30) a. John doesn't know Mary's pregnant and/but she is.

b. Mary is pregnant and/but John doesn't know it.

The judgment reported in Rothschild 2011 is that on the version with 'and', (30a) is better than (30b). However, this contrast disappears when 'and' is replaced with 'but'. To the extent that 'but' is analyzed underlyingly as conjunction, this would also be evidence that conjunction can show instances of symmetry.

On this basis, one might be tempted to conclude that the asymmetry of conjunction is only illusory, or at best only a tendency rooted in the fact that interpretation of a sentence happens incrementally from left-to-right. With enough effort (perhaps by paying a processing cost), one should have access to the symmetric filtering interpretation (Schlenker, 2008, 2009; Rothschild, 2011).

Experimental evidence Recent experimental evidence suggests that this is not the case. In a study that aimed to test the asymmetry of conjunction, Mandelkern et al. 2020 embedded conjunctions like (27b) vs (27c) into the antecedent of conditionals and tested their acceptability in explicit ignorance contexts like (27a). They found that (31c) was significantly more acceptable than (31b).

(31) a. **Context:** We have no knowledge of Mary's smoking habits

b. ✗If Mary stopped smoking and she used to smoke Marlboros, then ....

c. ✓If Mary used to smoke Marlboros and she stopped, then ....

Moreover, this difference in acceptability was driven by the presence of the presupposition; once the presupposition is removed no substantial difference in acceptability can be detected:

(32) a. **Context:** We have no knowledge of Mary's smoking habits

b. ✓If Mary frowns upon smoking and she used to smoke Marlboros, then ....

c. ✓If Mary used to smoke Marlboros and she frowns upon smoking then ....

Finally, the difference in acceptability between (27b) vs (27c) parallels statistically the difference in acceptability between (33) vs (34):

(33) a. **Context:** We have no knowledge of Mary's smoking habits

b. ✗If Mary stopped smoking, then ...

(34) a. **Context:** We know that Mary used to smoke.

b. ✓If Mary stopped smoking, then ...

Assuming that the only thing that can save (33) is locally accommodating the presupposition in the antecedent, this parallelism suggests that the presence of the second conjunct in (31b) plays no role in helping filter the presupposition: one has to resort to local accommodation just like in (33) when the second conjunct is simply not present. This in turn is evidence against the idea that a symmetric filtering interpretation should be available at a processing cost.

Summary Given this background, I am going to assume the following generalization:

(35) **Filtering in Conjunction:** Filtering in conjunction is asymmetric. Material in the left conjunct can be used to filter a presupposition in the right conjunct, but not the other way around.

3.2.3.2. Disjunction

Preliminaries Disjunction is the connective that got the (a-)symmetry discussion going on the basis of examples like the following (Hausser, 1976; Soames, 1989):

(36) a. **Context:** We have no knowledge whether or not there is a bathroom in the house we are in

b. Either the bathroom is in a weird place or this house has no bathroom.

c. Either this house has no bathroom or the bathroom is in a weird place.

From the perspective of taking presupposition projection to be asymmetric by default, there have been two kinds of response to the apparent symmetry of disjunction. One response is the symmetry-as-cost view, which takes the symmetric interpretation to be available under a processing cost. The other response has been to treat cases like (36b) as involving local accommodation Hirsch & Hackl 2014. In the latter approach, the idea is that as a comprehender is interpreting (36b) from left to right, the presupposition that there exists a bathroom initially projects and becomes globally accommodated in the context. However, when the comprehender realizes that they are dealing with a disjunction where the second disjunct raises the possibility that there is no bathroom, they backtrack, and instead accommodate the presupposition of the first disjunct **locally** (so that the information that there is a bathroom does not end up in the global context). To the extent that local accommodation is a dispreferred/costly option, this view parallels the symmetry-as-cost view in predicting that (36c) carries a cost that (36b) doesn't have.

Experimental evidence Recent experimental evidence suggests that neither the 'symmetry-as-cost' nor the 'symmetry-as-local-accommodation' views can explain the behavior of disjunction. Kalomoiros & Schwarz (Forth) (see also chapter 2) transferred the Mandelkern et al. 2020 design reported above for conjunction to disjunction data. They compared disjunctions like (37b) to disjunctions like (37c) in Explicit Ignorance contexts and found no differences in acceptability; again the disjunctions were embedded in the antecedent of a conditional.[47]

(37) a. **Context:** I'm organizing a spelunking trip to a difficult cave. Back in college, Kat had an interest in extreme sports, although I don't know how she feels about the dangers involved in them these days. Also, I have no idea if she ever actually tried spelunking.

[47] See Kalomoiros & Schwarz 2021 for parallel experimental results where the disjunctions were unembedded.

So, I thought:

b. If Kat either has stopped doing spelunking or has never done any kind of spelunking, then this trip is not for her.

c. If Kat either has never done any kind of spelunking or has stopped doing spelunking, then this trip is not for her.

In fact, the sentences were as acceptable as corresponding sentences that lacked any presupposition trigger, like (38a) and (38b):

(38) a. **Context:** If Kat either frowns upon doing spelunking or has never done any kind of spelunking, then this trip is not for her.

b. If Kat either has never done any kind of spelunking, or frowns upon doing spelunking then this trip is not for her.

In this respect, disjunction already seems to differ from conjunction, where the contrast between presuppositional sentences exceeded any contrasts between non-presuppositional sentences.

Finally, removing the non-presuppositional disjunct gave rise to projection-related infelicities. (39b) is less acceptable than (40b):

(39) a. **Context:** I'm organizing a spelunking trip to a difficult cave. Back in college, Kat had an interest in extreme sports, although I don't know how she feels about the dangers involved in them these days. **Also, I have no idea if she ever actually tried spelunking**. So, I thought:

b. If Kat has stopped doing spelunking, then this trip is not for her.

(40) a. **Context:** I'm organizing a spelunking trip to a difficult cave. Back in college, Kat had an interest in extreme sports, although I don't know how she feels about the

dangers involved in them these days. **I know that in college she often used to go spelunking**. So, I thought:

b. If Kat has stopped doing spelunking, then this trip is not for her.

Similarly to the Mandelkern et al. 2020 reasoning for conjunction, the contrast between (39b) and (40b) gives us a measure of the acceptability of sentences where no material capable of filtering the presupposition is present. The point is that no such contrast is found between (36b) vs (36c); hence the "has never done any kind of spelunking" disjunct facilitates getting rid of the presupposition of the other disjunct in a way that goes over and above any other presupposition-canceling processes (like local accommodation) that should be equally available for (39b).

The picture that emerges then is one of a stark contrast between conjunction and disjunction. Material in the second conjunct cannot easily help with filtering a presupposition in the first conjunct, (31b). But material in the second disjunct can very easily help filter a presupposition in the first disjunct, (37b).

Summary Thus, it looks like disjunctions allow material in the second disjunct to affect the presuppositions in the first disjunct, in stark contrast to conjunctions. For the purposes of the current chapter then, we will assume the following generalization:

(41) **Filtering in Disjunction:** Filtering in disjunction is symmetric. Material in the left disjunct can be used to filter a presupposition in the right conjunct, and also material in the right disjunct can be used to filter a presupposition in the left disjunct.

Already we can see why the view that takes asymmetric filtering to be the preferred default option **uniformly across connectives** is not tenable: the experimental data show that the impact of linear order on presupposition projection is **not uniform** by connective. Conjunctions indeed do not easily allow material in the right conjunct to filter a presupposition in the left conjunct, but disjunctions do.

3.2.3.3. Conditionals

Preliminaries Projection from the antecedent of conditionals is almost definitional of presupposition. Consider the following classic case, from Karttunen 1973:

(42) a. ✗If all of Jack's children are bald, then Jack has children.

b. ✓If Jack has children, then all of Jack's children are bald.

In (42a), the antecedent presupposes that Jack has children. Even though the consequent carries this information, the whole conditional carries a presupposition that jack has children. To get the information that 'Jack has children' to filter the presupposition , the antecedent and the consequent need to exchange places, as in (42b). Now the conditional carries no presupposition about whether or not Jack has children. This then points to a fundamental asymmetry: presuppositions in the antecedent cannot be filtered when entailed by the consequent. But presuppositions in the consequent can be filtered when entailed by the antecedent.

Bathroom conditionals? The question is whether there are any circumstances in which material in the consequent can filter a presupposition in the antecedent. Symmetric theories like Strong Kleene and symmetric Transparency predict that a conditional like $(if\ p'p.\ q)$ presupposes that $C \models \neg q \rightarrow p'$.[48] Thus, as long as the negation of the consequent entails the presupposition of the antecedent, the overall presupposition predicted by symmetric accounts is satisfied and the conditional should be acceptable in all contexts (in other words symmetric filtering is available in this case). The cases that have been considered in the literature, Schlenker (2008, 2009), concentrate around so-called 'bathroom conditionals' which trade on the *or-to-if* tautology from classical logic:

[48] See section 3.2.2.1 for a reminder of why this holds in Strong Kleene. For symmetric Transparency, the relevant condition is:

(i) For all p: $C \models (if\ p'p.q) \leftrightarrow (if\ p.\ q)$

This holds just in case $C \models \neg q \rightarrow p'$, (Schlenker, 2007). The same prediction is made by symmetric dynamic semantics (see section 3.6).

(43) a. **Context:** We've been searching the house for a bathroom, unable to find one. We have no idea if a bathroom actually exists.

b. If the bathroom is not in a weird place, then this house has no bathroom.

In (43) the negation of the consequent entails the existence of a bathroom (the presupposition of the antecedent). And indeed (43) does not appear to presuppose the existence of a bathroom.[49] Moreover, Chemla & Schlenker 2012 present experimental evidence that at least some cases of this kind show symmetric interpretations that go over and above local accommodation, and thus represent cases of symmetric filtering. At the same time, there are two questions: 1) do all triggers show this symmetry, and 2) is the symmetry replicated in cases where the negation in the antecedent is absent. Let's start with the first of these questions by considering the following example:

(44) a. **Context:** We know that anyone who smokes Marlboros, never gives up smoking. We have no idea if John has ever smoked. However, we know that:

b. ?If John doesn't continue to smoke, then he didn't use to smoke Marlboros.

Formally, (44) is parallel to (43): both exhibit a presupposition trigger in the antecedent that is negated. However, there is an intuition that (44) presupposes that John used to smoke, despite the negation of the consequent entailing the relevant presupposition (contrary to the absence of a presupposition in (43)). To the extent that this judgment holds, it suggests that symmetric effects in conditionals are not simply accessible just as soon as we negated the antecedent. The identity of the trigger also matters. This is unexpected under a view where symmetric filtering is *generally*

[49] In this respect examples like the following also appear rather striking:

(i) a. **Context:** We see John smoking a cigarette, but we have no idea if he has ever smoked in the past.

b. If John is not smoking again, then he has never smoked before.

What seem to happen in these cases is that the assertive component of the antecedent 'that John is currently smoking' is established in the context, and the negation seems to have a chance to target the presupposition. Whether or not these represent cases of genuine filtering is not clear to me. One possibility is that they represent cases of local accommodation that is made easier by the impossibility of denying the assertion. At the same time, anaphoric triggers like 'again' are supposedly very resistant to local accommodation, (Simons, 2001; Abusch, 2010). Currently, the status of this kind of case is open.

available (even if costly).

What about the question of what happens when we remove the negation from the antecedent? Consider the following:

(45) a. **Context:** We are in building with three floors and we are looking for a bathroom. We have been looking in the third floor, which is the most used floor in the building, but we have found no bathroom so far. In fact, we have no idea if a bathroom actually exists in the building. So, we think:

b. ?If the bathroom is on a floor that's not used much, then the third floor has no bathroom.

(46) a. **Context:** We find a full pack of Lucky Strikes in the dustbin of John's office, but we can't be sure they belong to him. In fact we have no knowledge of his smoking habits.

b. ?If John continues smoking, then he didn't use to smoke Lucky Strikes.

Recall that on the accounts where full symmetry is available (even if costly), the prediction is that if the negation of the consequent entails the presupposition of the antecedent, then filtering should occur. This is regardless of whether the antecedent is negated. However, (45b) and (46b) appear intuitively to presuppose respectively that there is a bathroom in the building and that John used to smoke. As such they are somewhat degraded compared to (43). Again, this goes against the idea that information in the consequent is *generally* available (even if costly) for filtering a presupposition in the antecedent.

The discussion so far then suggests that access to material in the consequent for the purposes of filtering a presupposition in the antecedent appears conditioned 1) by the presence of negation in the antecedent, 2) as well as the identity of presupposition trigger that is being negated.

Antecedent-final conditionals: the issue Note that an interesting case that could allow one to tease apart the effects of (a-)symmetry in conditionals is represented by antecedent-final conditionals like (47a):

(47) a. John ate a strawberry on Friday, if he ate a banana again on Wednesday.

b. $(q.\ if\ p'p)$

Let's consider what the various approaches we reviewed previously predict here. Take Transparency first. On the asymmetric version of the constraint, the requirement imposed is:

(48) For all p, for all β: $C \models (q.\ if\ p'p\ \beta \leftrightarrow (q.\ if\ p\ \beta$

Note that since the only good final β is the closing parenthesis, the requirement can be re-written as:

(49) For all p: $C \models (q.\ if\ p'p) \leftrightarrow (q.\ if\ p)$

This is exactly the same requirement as the one imposed by symmetric Transparency. Therefore, antecedent final conditionals represent a case where symmetric and asymmetric Transparency derive the same presupposition; in this case Transparency is satisfied just in case $C \models \neg q \rightarrow p'$. Therefore, (47a) is predicted to presuppose:

(50) If John didn't eat a strawberry on Friday, he ate a banana before Wednesday.

The same result follows if we apply the incrementalized Strong Kleene algorithm: the requirement imposed in that case is that $(q.\ if\ p'p\beta$ should never receive the # value (on the Strong Kleene algorithm) in the context for any β. Since the only possible β is the closing parenthesis, this requirement becomes that $(q.\ if\ p'p)$ should never be #. We know that this holds just in case $C \models \neg q \rightarrow p'$.

Interestingly, a trivalent approach that takes the Middle Kleene tables to be the default option, with the Strong Kleene tables accessible at a cost, makes different predictions here. On the Middle Kleene table, the undefinedness of the antecedent is inherited by the whole sentence regardless of the consequent. Thus, (47a) is predicted to presuppose the presupposition of its antecedent without a cost:

(51) John ate a banana before Wednesday.

The conditional presupposition that Strong Kleene derives, namely (50), is also predicted to be accessible, but at a cost.

A similar result is expected under a dynamic approach where asymmetry is preferred. The dynamic entry for a conditional predicts that the whole conditional is undefined if the presupposition of the antecedent is not supported in the context. This holds both for antecedent-initial conditionals and for antecedent-final conditionals. Therefore, the default presupposition of (47a) should be (51)

At the same time, if one can access a symmetric dynamic entry, then the conditionalized presupposition in (50) should also be available, but at a cost.

Things become even more interesting when we contrast (47a) with its reverse:

(52) If John ate a banana again on Wednesday, he ate a strawberry on Friday.

On the view that the asymmetric version of Transparency applies by default (with symmetry only possible at a processing cost), the conditionalized presupposition in (50) requires access to symmetric filtering and hence should be available at a cost. Conversely, the simple, unconditional presupposition in (51) should be available by default. The same holds for incrementalized Strong Kleene. And the very same prediction is made by trivalent approaches that take Middle Kleene as the preferred default, as well as by dynamic approaches that make asymmetric entries the preferred default. In all of these cases, (51) is accessible without a cost, while (50) is accessible at a cost.

The upshot of this discussion is that antecedent-final conditionals represent a point where various approaches part ways: incrementalized Transparency/Strong Kleene predict a contrast between (47a) vs (52): (47a) has costless access to the conditional presupposition in (50), whereas (52) has access to this presupposition only at a cost. Conversely, 'preferred Middle Kleene', and incrementalized dynamic approaches with a preference for asymmetry predict no such contrast: both (47a) and (52) have costless access to a the presupposition in (51), and costly access to the conditionalized presupposition in (50). This state of affairs is summarized in tables 3.7 and 3.7: '✓' indicates costless access to a presupposition, '?' indicates that access to a certain presupposition is costly, and '*' indicates no access to a presupposition.

Sentence	$C \models p'$	$C \models \neg q \to p'$
$(q.\ if\ p'p)$	*	✓
$(if\ p'p.\ q)$	✓	?

Table 3.6: Predictions of Incrementalized Transparency and Incrementalized Strong Kleene

Sentence	$C \models p'$	$C \models \neg q \to p'$
$(q.\ if\ p'p)$	✓	?
$(if\ p'p.\ q)$	✓	?

Table 3.7: Predictions of 'Middle Kleene + Strong Kleene' and Incrementalized Dynamic Semantics

Antecedent-final conditionals: the empirical picture The only experimental foray into antecedent-final conditionals that I'm aware of is Schwarz 2015, who compares antecedent-initial and antecedent-final conditionals in terms of their projection properties, by looking at sentences like the following:

(53) a. If John ate a banana again on Wednesday, he ate a strawberry on Friday.

b. John ate a strawberry on Friday, if he ate a banana again on Wednesday.

Schwarz 2015 used a covered box study to test whether there is a presuppostion-related contrast between (53a) and (53b). Without going into the gory details of the design, the result was that there is indeed a contrast between them; this is unexpected under the 'preferred Middle Kleene/asymmetric dynamic entries' approach, but expected under the 'incrementalized Transparency/Strong Kleene' approaches.

At the same time, the results did not end up fully vindicating the latter approach either. Recall that the 'incrementalized Transparency/Strong Kleene' approaches predict that antecedent-initial conditionals, (53), should have default access to the unconditionalized presupposition in (54a), but also costly access to the conditionalized presupposition in (54b).

Therefore, in a context where John didn't eat a banana before Wednesday, but ate a strawberry on Friday, then the preferred presupposition of the antecedent-initial case, (53a) (namely (54a)) isn't satisfied; but the presupposition that is available at a cost (namely (54b)) is (since the antecedent is false, the conditional is true).

(54) a. John ate a banana before Wednesday.

b. If John didn't eat a strawberry on Friday, he ate a banana before Wednesday.

Conversely, in contexts where John didn't eat a banana before Wednesday, and didn't a strawberry on Friday, then neither the preferred nor the costly presupposition of (53a) is satisfied.

So, in the first kind of context, the antecedent-initial conditional is expected to be more acceptable than in the second kind of context. However, the results of Schwarz 2015 showed no difference between the two kinds of context, which casts some doubt on the idea that antecedent-initial conditionals allow access to the material in the consequent, as would be expected on an approach that allows costly symmetric filtering across the board.

Given this, it's conceivable that these results are best explained in terms of fully asymmetric Transparency; this would predict the contrast between (53a) vs (53a), and would also predict that (53a) presupposes that 'John ate a banana before Wednesday' regardless of the truth of 'John ate a strawberry on Friday'. But then we cannot use filtering to explain the cases of apparently symmetric conditionals with negated antecedents we discussed in (43). The only option left would be local accommodation.

A final twist in this saga comes from the fact that, in contrast to the results of Schwarz 2015, Mandelkern & Romoli 2017 cast doubt on the idea that information in the consequent can ever filter a presupposition in the antecedent in antecedent-final conditionals. They use examples like the following:

(55) John isn't in Paris, if he isn't happy that he's in France.

According to Transparency, the presupposition here is that "if John is in Paris, then he is in France'. This is a tautology, so (55) should be acceptable without imposing any constraints on the context. However, the judgment given in Mandelkern & Romoli 2017 is that (55) presupposes that John is in France. Their solution is to update the definition of asymmetric Transparency to avoid predicting filtering in this case. But then then we would end up being unable to capture the contrast between (53a) vs (53a) found in Schwarz 2015.

One possibility is that this might be another case where different presupposition triggers behave differently, with perhaps 'again' functioning more in lines with the predictions of Transparency, but with emotive factives like 'happy' functioning more along the lines of a Middle Kleene solution. But there is currently no controlled empirical study to support this speculation.

Summary It is clear that a lot more careful empirical studies are needed in the case of conditionals, to clarify the status of (a-)symmetries. It is conceivable that all purported cases of symmetric filtering could be explained as the result of local accommodation. However, if we take the cases of conditionals with negated antecedents, as well as the results of Schwarz 2015 at face value, then we can state the following generalization for at least some triggers:

(56) **Filtering in Conditionals:** Antecedent-initial conditionals with unnegated antecedents do not seem to allow symmetric filtering. For antecedent-initial conditionals with negated

antecedents, symmetric filtering might be allowed, (43). Antecedent-final conditionals allow the consequent to affect the antecedent in terms of filtering (*pace* Mandelkern & Romoli 2017)

Again, this is a pattern where symmetric filtering is not uniformly available for all kinds of conditionals. Thus, it isn't captured on the 'default asymmetric, costly symmetric' approach, which applies uniformly across all conditionals.

3.2.3.4. Multiple triggers

Another facet of the problem of (a-)symmetry is whether presuppositional material that follows a presupposition trigger can have an impact on what is projected by that trigger. In a theory where symmetric effects are allowed, this is in principle something to be expected. However, in the theories that do allow some measure of symmetry, the symmetric effect of one presupposition trigger on some other trigger that precedes it doesn't always lead to good results.

Conflicting triggers Disjunctions whose disjuncts carry contradictory presuppositions are an example of a case where, even though symmetric interaction between triggers seems to be called for, the kinds of symmetric proposals that have been developed in the literature fail to deliver intuitively correct results, (Gazdar, 1979; Soames, 1979, 1982; Landman, 1986; Beaver, 2001; Beaver & Krahmer, 2001; Romoli, 2011). Consider first the example below:

(57) Either John stopped smoking or he started smoking.

The first disjunct in isolation presupposes that John used to smoke; the second disjunct in isolation presupposes that John didn't use to smoke. However, it seems fairly clear that the whole of (57) presupposes neither that John used to smoke nor that John didn't use to smoke. In some sense, contradictory presuppositions cancel each other out in disjunctions.

Examples of this sort have received some attention, particularly in the context of arguing against semantic approaches to presupposition. In a trivalent approach based on the Strong Kleene system, we can develop the following line of reasoning: either John used to smoke, or he didn't use to smoke (this is simply a tautology, so it's true in all contexts). If he used to smoke, then the presupposition of the first disjunct in (57) is satisfied, but the presupposition of the second disjunct is not. This means that the second disjunct receives the # value. The first disjunct will receive a classical value, either 1 or 0. If 1, the whole sentence is true. If 0, the whole sentence is undefined. Crucially, if we now assume that John didn't use to smoke, it is the first disjunct that is undefined, and the second disjunct that is 1 or 0. We can then repeat the same reasoning as before and derive that again the disjunction is either 1 or #. Therefore, on the Strong Kleene account of presupposition, (57) can never be false in any context; only true or undefined.

A consequence of this is that (57) presupposes what it asserts. Recall the idea of Stalnaker's Bridge, whereby for a sentence to be acceptable in a context C, it cannot be # in any C-world. We showed in the previous paragraph that in all contexts, (57) is either true or undefined. If we take away the cases where it's undefined, we are only left with contexts where (57) is true. So, for (57) to not be # in some world in C, every world in C must make it true.

A similar result follows under a symmetric Transparency approach, since the Transparency constraint imposes the following two conditions on a sentence like $(p'p \textit{ or } q'q)$:

(58)
- For all p: $C \models (p'p \textit{ or } q'q) \leftrightarrow (p \textit{ or } q'q)$
- For all q: $C \models (p'p \textit{ or } q'q) \leftrightarrow (p'p \textit{ or } q)$

Going through the relevant computations reveals that these conditions are satisfied just in case $C \models (p'p \textit{ or } q'q)$.[50]

To the extent that a sentence like (57) can be used in contexts where it's not already established, then this is an undesirable result.[51] A common solution to this is to invoke some kind of

[50]Suppose the conditions are satisfied. Then they are satisfied for $p = \top$ and $q = \top$. In these cases, it follows that $C \models (p' \textit{ or } q'q)$ and $C \models (p'p \textit{ or } q')$. Therefore, $C \models (p' \textit{ or } q'q) \textit{ and } (p'p \textit{ or } q')$. Given that $p' = \neg q'$, this last is equivalent to $C \models (p'p \textit{ or } q'q)$. Conversely, if $C \models (p'p \textit{ or } q'q)$, then the two conditions in (58) are satisfied, again assuming that $p' = \neg q'$.

[51]That said, I'm personally not convinced that this kind of sentence can be used in just about any context. I find

local accommodation procedure (either via insertion of an A-operator as in Beaver & Krahmer 2001, although see Romoli 2011 for some of the dangers that such a move might involve, or through some other kind of accommodation operation as in Schlenker & Chatain 2023) whereby the presuppositions carried by the disjuncts are not allowed to project.

Entailing presuppositions The flip-side of the situation above is the case of presupposition triggers where one of the triggers entails the presuppositions of the other. Consider for instance the case of a conjunction like (59):

(59) John stopped smoking and he stopped smoking Marlboros.

As observed by Rothschild 2011 (see also Beaver 2008 for relevant discussion), on a theory like symmetric Transparency, the prediction is that (59) should be acceptable in all contexts (even ones where it's not established that John used to smoke), since the second conjunct entails the presupposition of the first. However, there is a clear intuition that (59) presupposes that John used to smoke Marlboros. Therefore, the possibility of symmetric Transparency in conjunction would run afoul of cases of this sort.

Similar problematic cases can be constructed with disjunctions. Rothschild 2011 for instance

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it most natural in contexts like the following:

(i) a. **Context:** I was with Bill the other day. Someone offered him a cigarette. He lit it and immediately started coughing. Bill would not have accepted the cigarette if he were someone who is against smoking. At the same time, the coughing indicates that he either hadn't smoked in a really long time, or he is a newbie. Therefore:
b. Either John stopped smoking or he started smoking.

In this kind of context, the chain of reasoning essentially establishes that John either used to smoke and currently doesn't (hence the coughing) or he's very new at it (hence the coughing). So arguably, what the sentence asserts is already entailed by the context; the sentence just brings it out more clearly.

More problematic is the following kind of example (cf. Landman 1986, see also Beaver 2001 for discussion):

(ii) Mary met either the King or the President of Buganda.

In a context where we know that Buganda has a head of state and that head is either a King or a President, then this is a perfectly fine thing to utter, without also having to know that Mary met them. Therefore, even if one wanted to maintain that at least for some triggers there is something in the prediction that disjunctions of contradictory presuppositions presuppose themselves, something extra has to be said in the case of definites.

considers the following case:

(60) Either Mary doesn't regret that she used to smoke or she didn't stop smoking.

On the symmetric Transparency approach to this sentence, the prediction is that this is fully acceptable: the negation of the second disjunct entails the presuppositions of the first disjunct. However, it seems clear that the sentence presupposes that Mary used to smoke.[52]

In contrast, the way trivalent approaches introduce symmetry doesn't suffer from such problems. In a world where John never used to smoke, both disjuncts of (59) are undefined, and hence the whole sentence is undefined; the sentence is not # in a world w just in case John used to smoke Marlboros. In (60), something similar occurs: in worlds where Mary didn't use to smoke, both disjuncts are undefined, and hence the whole sentence is undefined.

Summary The lesson to be drawn from cases of multiple presupposition triggers is that even when symmetry is introduced, and even supposing that it can be introduced in just the right cases, *the way it is introduced matters.* On the one hand, in the case of conflicting presuppositions, neither the trivalent accounts of symmetry nor a bivalent, Transparency-based account of symmetry avoid the conclusion that such sentences presuppose what they assert. However, the two approaches come apart when considering entailing presuppositions, with the symmetric trivalent approach avoiding the issue of the presuppositions of a conjunct/disjunct being able to filter the presuppositions of a preceding conjunct/disjunct. We will come back to such examples when we consider our own ways of introducing symmetry in Transparency-like systems.

3.2.4. Interim conclusion

In reviewing the data that motivate a rejection of the 'default asymmetry, costly symmetry' view, we have come across a variety of cases that differentiate between the various approaches to filtering

[52] A way to overcome this difficulty, proposed by Schlenker 2008, is to modify Transparency along the following lines. Suppose that $S = \alpha\ p'p\ \beta$. Transparency now requires that for all p, $C \models \alpha^*\ p'p\ \beta^* \leftrightarrow \alpha^*\ p\ \beta^*$, where α^* and β^* are versions of α and β where all presuppositional material (all primed components) have been deleted, leaving only the assertive components of any expressions.

and its (a-)symmetries we have presented so far. These cases define a basic set of patterns and they will form the basic 'test suite' on which we will apply our own filtering systems that we develop in the remainder of this chapter.

As a summary of this test suite, the core examples that have motivated our filtering generalizations are repeated below. They come in two classes, depending on whether they involve one or multiple presupposition triggers. For each class, the formalization and the observed presupposition of each sentence is summarized in the two tables below ('?' indicates uncertainty about a presupposition).

(61) **Conjunction**

a. John stopped smoking and he used to smoke Marlboros

b. John used to smoke Marlboros and he stopped smoking

(62) **Disjunction**

a. Either John stopped smoking or he never used to smoke

b. Either John never used to smoke or he stopped smoking

(63) **Conditionals**

a. If all of Jack's children are bald, then Jack has children

b. If the bathroom is not in a weird place, then this house has no bathroom

c. John is in Paris if he's happy that he's in France

(64) **Multiple triggers**

a. Either John stopped smoking or he started smoking.

b. John stopped smoking and he stopped smoking Marlboros.

c. Either Mary doesn't regret that she used to smoke or she didn't stop smoking.

Formalization	Presupposition
$(p'p\ and\ q)$	$C \models p'$
$(q\ and\ p'p)$	$C \models q \to p'$
$(p'p\ or\ q)$	$C \models \neg q \to p'$
$(q\ or\ p'p)$	$C \models \neg q \to p'$
$(if\ p'p.\ q)$	$C \models p'$
$(if\ (not\ p'p).\ q)$	$?C \models \neg q \to p'$
$(q.\ if\ p'p)$	$?C \models \neg q \to p'$

Table 3.8: Summary of core patterns: Sentences with one trigger

Formalization	Presupposition
$(p'p\ or\ q'q)$, $p' = \neg q'$	No ps (although see fn 51)
$(p'p\ and\ q'q)$, $q' \models p'$	$C \models p'$
$((not\ p'p)\ or\ (not\ q'q))$, $\neg q' = p'$	$C \models p'$

Table 3.9: Summary of core patterns: Sentences with multiple triggers

3.3. The three systems: overview and intuitions

3.3.1. Initial desiderata

We have seen that the major approaches to symmetry in the literature over-generate: symmetry seems to be the default case for disjunction, and perhaps for conditionals with a negated antecedent; asymmetry seems to be the default for conjunctions and conditionals with an unnegated antecedent, with the extra complication that presuppositions in the antecedent of antecedent-final conditionals do not always project.

We can then ask the following questions:

- **Q1:** Can we group together conjunctions and conditionals to the exclusion of disjunction, in a way that derives asymmetry for conjunctions/conditionals but symmetry for disjunction?

- **Q2:** Can we dissociate antecedent-initial vs antecedent-final conditionals to capture the results of Schwarz 2015? Secondarily, can we dissociate conditionals with a positive antecedent vs those with a negated antecedent, in a way that limits the former to only left-to-right filtering, but allows right-to-left filtering for the latter?

Against this backdrop, we are going to develop three systems. The first two are collectively dubbed as *Limited Symmetry*. Both of them rest on a pragmatic understanding of presupposition and will involve a twist of Schlenker's Transaprency idea, essentially imposing a different kind of incremental filter that doesn't lead to full asymmetry across the board; however, one system will take presupposition triggers to be fully bivalent (*System 1*), whereas the other will allow triggers to introduce undefinedness (*System 2*). The third system will be a twist on dynamic semantics, where a template on update rules will be introduced. Whether a certain connective follows a given template will be fully predictable on the basis of the semantics of the connective. Given its dynamic origin, the third system will be structural, with a semantics that is sensitive to presupposition violations, in contrast to systems 1 and 2, which will operate linearly on the string representation of a sentence (although the semantics of *System 2* will be sensitive to presupposition).

In these systems, the questions above will receive the following answers: **Q1:** Yes, conjunctions and conditionals can be grouped together to the exclusion of disjunction, in a way that renders the former asymmetric, but the latter symmetric. Truth conditional differences between the connectives suffice to draw the required line. This is regardless of whether one takes presupposition triggers to be fully bivalent or to be introducing some kind of undefinedness. **Q2:** Yes the dissociation is possible in all three systems (with some choice points in the case of the third system; see section 3.6). However, the presence vs absence of a negation in the antecedent for the availability of right-to-left filtering makes a difference only in System 1. Table 1 below summarizes these predictions:

Sentence	System 1	System 2	System 3
$(p'p\ and\ q)$	$C \models p'$	$C \models p'$	$C \models p'$
$(if\ (not\ p'p).\ q)$	$C \models \neg q \rightarrow p'$	$C \models p'$	$C \models p'$
$(if\ p'p.\ q)$	$C \models p'$	$C \models p'$	$C \models p'$
$(q.\ if\ p'p)$	$C \models \neg q \rightarrow p'$	$C \models \neg q \rightarrow p'$	$C \models p'/C \models \neg q \rightarrow p'$
$(p'p\ or\ q)$	$C \models \neg q \rightarrow p'$	$C \models \neg q \rightarrow p'$	$C \models \neg q \rightarrow p'$

Table 3.10: Summary core predictions for System 1 vs System 2 vs System 3

We now proceed to give brief overviews of the intuitions that underlie the workings of the three systems.

3.3.2. Intuitions

3.3.2.1. System 1: Full bivalence

Here's the intuition: presuppositions are indeed subject to a Transparency constraint that requires them to be redundant. Let's adopt Schlenker's notation for presupposition-bearing atomic sentences, and focus on the classic conjunction case of $(p'p\ and\ q)$. Establishing Transparency here boils down to establishing a bijection between the worlds in the context where $(p'p\ and\ q)$ is true and the worlds in the context where $(p\ and\ q)$ is true (for all p): they need to be the same worlds, i.e. it needs to hold that

(65) $\forall p : \{w \in C \mid (p'p\ and\ q) \text{ is true}\} = \{w \in C \mid (p\ and\ q) \text{ is true}\}$

Algorithmically, there are various ways in which we might imagine comprehenders trying to compute this bijection as they are parsing the sentence incrementally. One option is for them to wait until they have the full sentence and then check the Transparency constraint; this would give rise to symmetric Transparency. Another way would be to try and establish the full bijection as soon as they get access to the presupposition bearing conjunct $p'p$. This strategy would be applying the asymmetric Transparency definition. We have seen that neither of these strategies is going to cut it. Instead, we propose a third strategy: at every point as they are parsing the sentence, comprehenders are trying to build as much of the bijection as they can. If at some point they find out that this is not possible, then presupposition failure ensues.

Here's how this intuition can be implemented. Establishing that the condition in (65) holds boils down to establishing that:

(66) a. $\forall p : \{w \in C \mid (p'p\ and\ q) \text{ is true}\} \subseteq \{w \in C \mid (p\ and\ q) \text{ is true}\}$

b. $\forall p : \{w \in C \mid (p'p\ and\ q) \text{ is false}\} \subseteq \{w \in C \mid (p\ and\ q) \text{ is false}\}$[53]

[53]This condition is just the contraposition of $\forall p : \{w \in C \mid (p\ and\ q) \text{ is true}\} \subseteq \{w \in C \mid (p'p\ and\ q) \text{ is true}\}$.

When the comprehender gets access to the partial string `(p'p and` they realise that they are dealing with a presupposition p', which needs to be Transparent. They also know a few non-trivial things about the sentence: **i)** however the sentence ends, its completion must have the form δ`)` for some sentence δ.[54] Therefore, they also know that to check whether p is Transparent, they need to check whether $(p'p\ and\ \delta)$ and $(p\ and\ \delta)$ are equivalent. **ii)** they also know that the sentence is already false in all worlds where $p'p$ is false, regardless of the actual completion δ. Assuming a bivalent semantics where $p'p$ is interpreted conjunctively, the sentence is then false in all worlds where $p' = 0$ or $p = 0$. Similarly, $(p\ and\ \delta)$ is already false in all worlds where p is false.

Since no information is available about the actual completion $\delta)$ the comprehender does not have access to the worlds where the sentence and presupposition-free version are true/false. Therefore, it's not possible to establish the full bijection. However, whatever the eventual bijection turns out to be, it will need to identify all the worlds where $p'p$ is false with worlds where p is false (for all p), otherwise the condition in (66b) above will fail. This **is** something that can be checked already at this point, and the comprehender goes ahead and does that. One intuition to justify this action is to assume that when comprehenders try to build the rest of the bijection, they will not have to worry about identifying cases where $p'p$ is false with cases where p is false; they will have already done this earlier, hence will have less requirements to hold in memory.

Thus, they have to establish that:

(67) $\forall p : \{w \in C \mid p' = 0\ or\ p = 0\} \subseteq \{w \in C \mid p = 0\}$

We can show this more graphically by means of the following diagram:

This is to be read as follows: the downwards pointing arrows represent time flowing from the past to the future. Against each time axis, we have set the sentences that must be shown to be equivalent, each being broken down into the symbols that comprehenders get access to as time

[54] This is a simple consequence of the fact that if there were no second conjunct and no closing parenthesis we would not be dealing with a well-formed formula.

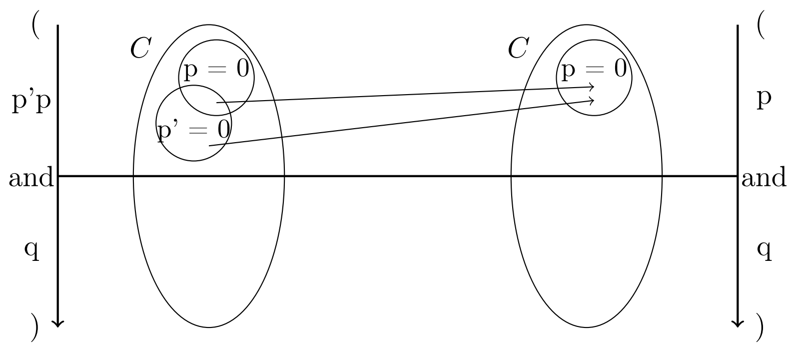

Figure 3.1: Checking part of the required bijection between ($p'p$ *and* q) vs (p *and* q) at the point where the parser has access to `(p'p and` vs `(p and`

passes. The horizontal line connecting corresponding points in the two sentences delineates the point in the parse of the sentence that comprehenders have found themselves at. When the line is at *and*, then comprehenders have access to `(p'p and` vs `(p and`. At these points, they can isolate subsets of the context C where the sentences are false, and they are trying to match the worlds where $p' = 0$ or $p = 0$ to the worlds where $p = 0$. This is easy enough for the $p = 0$ worlds as both sentences give access to them. However, the $p' = 0$ worlds that ($p'p$ *and* q) gives access to must be matched to $p = 0$ worlds, as (p *and* q) gives no automatic access to $p' = 0$ worlds at this point. This can happen only if the $p' = 0$ worlds are already $p = 0$ worlds. This is where the requirement that the matching needs to hold for all p comes in; if p is some tautology, then there are no worlds where it's false, and the worlds where $p' = 0$ have to matched to the empty set. But this is only possible if there are no worlds in C where $p' = 0$ in the first place. So in the context, we must only have $p' = 1$ worlds. The other direction also holds: if $C \models p'$, then the required identification of $p' = 0$ worlds with $p = 0$ worlds holds. So, unless $C \models p'$, comprehenders will not try to go further in building the required bijection, and the sentence suffers presupposition failure no matter what follows after `(p'p and`.[55]

[55]One could take the requirement to identify the worlds where $p' = 0$ with worlds where $p = 0$ (for all p) *at this point in the parse* as a hard constraint: unless $C \models p'$, this requirement cannot be satisfied and the process of building the bijection stops. Another way to think about it though is as processing default requirement that can be overridden at a cost. In that case, comprehenders would be able to ignore (for a processing cost) the fact that they cannot yet identify the worlds where $p' = 0$ with worlds where $p = 0$ (for all p). They would move on, hoping that eventually they would be able to identify the worlds where $p' = 0$ with worlds where S is false (after all, the bijection is between ($p'p$ *and* q) and (p *and* q); as long as worlds where ($p'p$ *and* q) are identified with worlds where (p *and* q) is false, the bijection still holds at the global level. This strategy would give them access to the second conjunct, which they could then use to filter the presupposition of the first conjunct, essentially going back to the original

From this perspective, it becomes clear that disjunction like ($p'p$ *or* q) will behave differently, simply because it gives access to a different set of worlds when a parser reaches `(p'p or`: at that point, we know that the disjunction is true in worlds where $p = 1$ and $p = 1$. We know nothing yet about where the sentence is false; for that, we need the second disjunct. Similarly, for (p *or* q) we get access to the worlds where $p = 1$. It is quite clear that all the worlds that are both p' and p are worlds that are p (for all p); hence the part of the bijection that we can check at this point is as expected:

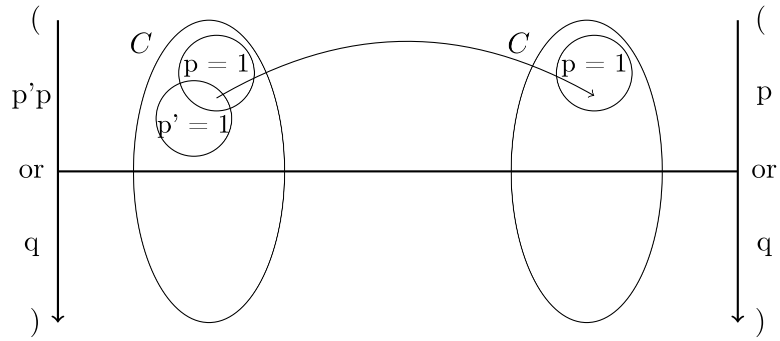

Figure 3.2: Checking part of the required bijection between ($p'p$ *or* q) vs (p *or* q) at the point where the parser has access to `(p'p or` vs `(p or`

Therefore, at this point no context creates any Transparency-related problem, and the parser can move on. Thus, we get a difference between conjunction and disjunction, where conjunction puts a Transparency-related requirement on the context as soon as one gets access to the first conjunct, whereas disjunction does not.

At this point, the predictive power of the theory becomes clear: suppose we have a connective with $p'p$ as its first argument; once the parser knows the connective and $p'p$, then we have some information about worlds where the whole sentence is true/false. If the connective forms a sentence that has a determined truth value wherever its first argument is true, then we are in a case analogous to the disjunction ($p'p$ *or* q) above. Conversely, if the connective forms a sentence that has a determined truth value wherever its first argument is false, then we are in a case analogous to

symmetric Transparency definition. However, note that even on this strategy where access to material following $p'p$ is possible in a conjunction, this access comes at a cost. No such cost is required for disjunctions on either strategy of constructing the bijection. Therefore, this still allows us to maintain a contrast between conjunction vs disjunction in the availability of right-to-left filtering. See also chapter 4 for more discussion.

($p'p$ *and* q).

The crucial thing to note is that as our basic semantics is completely bivalent, the presence of negation in the first argument can flip a case from being analogous to conjunction to being analogous to disjunction. For instance, in a simple conditional of the form ($if\ p'p.\ q$), we know as soon as we parse $p'p$ that the sentence is already true in all worlds where $p' = 0$ or $p = 0$. This makes the relevant calculation to build part of the bijection required by Transparency equivalent to the one for conjunction. But if we negate the antecedent, then the sentence is true in worlds where $p'p$ is true, hence the calculation now resembles the one for disjunction. This gives an intuition of how we group conditionals with simple antecedents together with conjunction (making them asymmetric), whereas conditionals with negated antecedents can behave symmetrically like disjunctions.

At the same time this same property creates other (a-)symmetry groupings as well: since ($p'p$ *and* q) and ((*not* $p'p$) *or* q) give access to the same worlds when one has parsed them up to the connective, they both impose a condition that $C \models p'$, whereas both ($p'p$ *or* q) and ((*not* $p'p$) *and* q) impose no conditions on the context at the point where the parser has only parsed the sentences up to the connective. So when negation gets involved, some conjunctions can behave like disjunctions and vice versa.

While this prediction is extremely interesting and allows us to capture the potential symmetry of conditionals with negated antecedents, there are two worries: one worry (already mentioned in the conditionals discussion in section 2) is that maybe not all conditionals allow symmetry when their antecedent is negated. The second worry is that there are currently no experimental data (that we are aware of) available on conjunctions/disjunctions with a negation in the first conjunct/disjunct, and it could turn out that these predictions are wrong.[56] Therefore, from a theoretical point of view, it is interesting to see if we can retain the underlying intuition that the (a-)symmetries of conjunction/disjunction have to do with the way comprehenders attempt to partially build a relevant Transparent mapping as they are parsing a sentence, while at the same time avoiding the 'flipping' effects caused by negation. System 2, whose underlying intuitions we present below, is an attempt

[56] See chapter 5 for an attempt (with mixed results) to test this experimentally.

at just that.

3.3.2.2. System 2: (quasi-)Strong Kleene

Consider the simple case of $S = p'p$. Negating it makes the sentence true in worlds where either $p' = 0$ or $p = 0$. This is the property that underlies the 'flipped' asymmetries above. It also means that the negation of a sentence carrying a presupposition p' is true (at least in the semantics) in worlds where the presupposition fails. This is somewhat counter-intuitive; if anything failure of a presupposition should put a sentence closer to falsity than truth. System 2 is based on the idea that we can give center-stage to the intuition that presupposition failure is more like falsity than truth, by starting with a Strong Kleene semantics, and then devising a system for integrating sentences into a context C: we will make the assumption that to integrate a sentence into C means finding the worlds where it is **accepted** vs **rejected**. In a bivalent system acceptance and rejection can be equated to to truth and falsity; a trivalent system like Strong Kleene offers more options. The idea is that undefinedness in a strong Kleene semantics should be grouped together with falsity, and the sentences rejected in those cases; otherwise (i.e. in the case when they evaluate to true) they are accepted.

For example $p'p$ is accepted iff $p' = 1$ and $p = 1$. It is rejected otherwise, i.e. in worlds where $p' = 0$ or $p = 0$. Again, we apply a similar constraint to the one we used in System 1: for all p, all the worlds where $p'p$ is accepted should be worlds where p is accepted, and all worlds where $p'p$ is rejected should be worlds where p is rejected. The interesting case is the worlds where $p'p$ is rejected: these include worlds where $p' = 0$, which are not included in the worlds where p is rejected. As in System 1, for the constraint to be satisfied, the set of $p' = 0$ worlds in the context must be empty.

Things become more interesting in considering the negation (*not* $p'p$). Following the idea that worlds where the Strong Kleene semantics makes the sentence undefined are worlds where the sentence is rejected, we can say that the sentence is rejected iff $p' = 0$ or $p = 1$. It is accepted in worlds where $p' = 1$ and $p = 0$. The twist lies in the fact that $p' = 0$ worlds are included in the words where (*not* $p'p$) is rejected. The corresponding worlds for (*not* p) are just worlds where $p = 0$.

For the constraint to be satisfied, it needs to hold that the context includes no worlds where $p' = 0$, just like for the $p'p$ case.

We can now see how this approach helps with getting negated conjunction to behave asymmetrically. In parsing a conjunction $((not\ p'p)\ and\ q)$ from left to right, we reach `((not p'p) and` at some point. In worlds where $p' = 0$ or $p = 1$, the first conjunct is either # or 0. From the Strong Kleene table for conjunction we know that in worlds where the first conjunct is false or undefined the whole conjunction will be either false or undefined, hence rejected. So, we can check our constraint at this point, and it turns out that for it to hold, p' needs to be true throughout the context.

In a similar fashion, this version of the system keeps disjunction symmetric, regardless of whether the first disjunct is negated. Conditionals on the other hand raise interesting problems, as Strong Kleene implication leads to unwanted symmetries. We discuss options of modifying the implication truth table, in order to get better results (hence the name (quasi-)Strong Kleene). We leave the fuller development of all this for section 5, where System 2 is presented.

3.3.2.3. System 3: Dynamics

The final system we develop is a variant of dynamic semantics. The core idea is to impose a template on what counts as a preferred update rule for a given connective. The template is based on a semantic criterion and whichever connective fulfills that criterion receives essentially an asymmetric entry, while connectives that don't fulfill it are unconstrained in terms of their update rule, which boils down to them being symmetric.

The core intuition behind the criterion is as follows: suppose we have a sentence formed with a binary connective $S = (\alpha * \beta)$. If all the worlds where S is true are a subset of the worlds where α is true, then this connective receives an asymmetric update rule. The same holds for connectives that form sentences $S = (\alpha * \beta)$ such that all the worlds where S is false are worlds where α is true. On the other hand, connectives that do not form sentences with these properties can use any update rule available to them, which means that they are associated with symmetric update rules.

Clearly, this draws a line between conjunction and conditionals on the one had, vs disjunctions on the other. With a conjunction, all the worlds where the conjunction is true are worlds where the first conjunct is true; and with a conditional, all the worlds where the conditional is false are worlds where the antecedent is true. Conversely, with a disjunction, the worlds where the disjunction is true tell us nothing about the truth of the first disjunct: indeed it's perfectly possible for a disjunction to be true in a world w without the first disjunct being true in w. The rest of this idea is developed more in section 6. For now, we turn to the development of *System 1* and its applications.

3.4. Limited Symmetry: System 1

3.4.1. Definitions

We are going to formalize the intuition that comprehenders check Transparency incrementally, on the basis of what worlds are available to them at a given point in the parse. We restrict ourselves to a propositional language $\mathcal{L}$ (inspired by Schlenker 2009):

Definition 3.4.1. $\mathcal{L}$

$$\phi := p_i \mid p'_j p_k \mid (not\ \phi) \mid (\phi\ and\ \ \phi) \mid (\phi\ or\ \phi) \mid (if\ \phi.\ \phi) \qquad i, j, k \in \mathbb{N}$$

In $p'_j p_k$, p'_j is meant to be understood as the entailments that have been marked as presuppositional and p_k as the non-presuppositional entailments. Below, we will omit subscripts and will be using lower case letters to name propositions ($p, q, r, \ldots$ etc.)

The intended models of this language are pairs $\langle W,\ I \rangle$, where W is a set of worlds, and I is a function assigning to each propositional constant of $\mathcal{L}$ a set of worlds. Our semantics is bivalent and follows the standard truth tables. Sentences that carry presuppositional entailments are treated like conjunctions (following Schlenker 2009):

Definition 3.4.2. Truth in a world

- p is T in w iff $w \in I(p)$
- $p'p$ is T in w iff $w \in I(p')$ and $w \in I(p)$

- $(not\ \phi)$ is T in w iff ϕ is F in w

- $(\phi\ and\ \psi)$ is T in w iff ϕ is T in w and ψ is T in w

- $(\phi\ or\ \psi)$ is T in w iff ϕ is T in w or ψ is T in w

- $(if\ \phi.\ \psi)$ is T in w iff ϕ F in w or ψ is T in w

We follow Schlenker 2009 in taking a sentence S to be evaluated against a context C (the global context), where C is a set of worlds (intuitively, the set of worlds that are live options in the current conversation).

Recall that checking the Transparency constraint for a sentence S (with respect to some of its atomic presuppositional sentences $p'p$) involves reasoning about a version of S where p has been substituted in the place of $p'p$ (removing the presuppositional component). Therefore, before we can define our constraint, we need to think a little how to effect this substitution operation.

To make things a little easier, we will assume that every atomic presuppositional sentence $p'_i p_j$ that appears in a sentence S is unique. This leads to no loss of generality, as for every sentence that has two instances of $p'_i p_j$ in its atomic components, we can just rewrite S by changing the extra instances of $p'_i p_j$ to $p'_k p_r$ stipulating that $p'_k p_r$ has the same semantics as $p'_i p_j$ (since we have infinite indices available this is not an issue).[57] This move ensures that every substitution operation only changes at most one thing in S and makes the reasoning later easier. Now we can define the following substitution operation:

Definition 3.4.3. Substitution

Given a sentence S and some presuppositional sentence $p'p$, the substitution of $p'p$ with p in S (written as $S_{p'p/p}$) is defined inductively as follows:

- $S := p$. Then $S_{p'p/p} = p$ (the substitution is vacuous)

[57] This trick is borrowed from Rothschild 2008, who applies it in reasoning about Schlenker's symmetric Transparency theory.

- $S := p'p$. Then $S_{p'p/p} = p$
- $S := (not\ \alpha)$. Then $S_{p'p/p} = (not\ \alpha_{p'p/p})$
- $S := (\alpha\ and\ \beta)$. Then $S_{p'p/p} = (\alpha_{p'p/p}\ and\ \beta_{p'p/p})$
- $S := (\alpha\ or\ \beta)$. Then $S_{p'p/p} = (\alpha_{p'p/p}\ or\ \beta_{p'p/p})$
- $S := (if\ \alpha.\ \beta)$. Then $S_{p'p/p} = (if\ \alpha_{p'p/p}.\ \beta_{p'p/p})$

Now we can define our new notion of Transparency:

Definition 3.4.4. Transparency$_{LS}$

For all sentences S, for all contexts C: If S begins with a substring of the form $\alpha\ p'p$, then S is acceptable in C iff for all κ such that $\alpha p'p\ \kappa$ is a substring of S, it holds that:

- For all p: $\{w \in C \mid \forall\beta : \alpha\ p'p\ \kappa\ \beta$ is true in $w\} \subseteq \{w \in C \mid \forall\beta : \alpha\ p\ \kappa\ \beta$ is true in $w\}$
- For all p: $\{w \in C \mid \forall\beta : \alpha\ p'p\ \kappa\ \beta$ is false in $w\} \subseteq \{w \in C \mid \forall\beta : \alpha\ p\ \kappa\ \beta$ is false in $w\}$

The definition in 3.4.4 formalizes the intuitions of the preceding section. The idea is that as soon as the parser hits upon a presuppositional expression $p'p$ in a sentence S, they check whether all the worlds where S is already true regardless of continuation, are worlds where $S_{p'p/p}$ is true at the corresponding point regardless of continuation.[58] This checking is repeated for all κ such that $\alpha p'p\ \kappa$ is a substring of S. So if $S = (p'p\ and\ q)$, the definition will start taking effect at `(p'p`; the κ will be any substring which added to `(p'p` makes a substring of S: in this case, $\kappa \in \{\epsilon,\ and,\ and\ q, and\ q)\}$ (ϵ is the empty string).

The rest of this section is devoted to applying the Transparency$_{LS}$ definition to some core cases involving conjunction, disjunction, conditionals and negation. Initially, the presentation will be detailed, carefully applying the definitions and showing how they lead to the claimed results.

[58] It makes sense to talk of the 'corresponding parsing point' as S and $S_{p'p/p}$ have the same length, since $S_{p'p/p}$ is exactly like S with the only difference that $p'p$ has been changed to p.

However, as more cases are examined and the reader presumably becomes more familiar with the approach, the presentation will be grounded more on intuitions rather than rigorous application of definitions.

3.4.2. Conjunction

Let's start with a simple conjunction of the form $(p'p \ and \ q)$.

Fact 3.4.1. *$(p'p \ and \ q)$ satisfies $Transparency_{LS}$ iff $C \models p'$.*

Assume that $(p'p \ and \ q)$ satisfies $Transparency_{LS}$. For $(p'p \ and \ q)$, the constraint becomes operative at parsing point `(p'p`. The constraint requires that for all κ such that $(p'p \ \kappa$ is a substring of $(p'p \ and \ q)$, it should hold that

- For all $p: \ \{w \in C \mid \forall\beta: \ (p'p \ \kappa \ \beta$ is true in $w\} \subseteq \{w \ inC \mid (p \ \kappa$ is true in $w\}$
- For all $p: \ \{w \in C \mid \forall\beta: \ (p'p \ \kappa \ \beta$ is false in $w\} \subseteq \{w \ inC \mid (p \ \kappa \ \beta$ is false in $w\}$

The first κ we can consider is the empty string ϵ:

$\kappa = \epsilon$. For `(p'p`, the set of worlds where $[\forall\beta$, `(p'p` $\beta]$ is true is empty; the same holds for the set of worlds where $[\forall\beta$, `(p'p` $\beta]$ is false. Since β could be anything, including both `and` $\bot)$ and `and` $\top)$, no such worlds exist. [59] Since the empty set entails everything, the required subsethoods hold.

$\kappa = and$. We parse the next symbol and get access to `(p'p and`; we can now calculate a set such that for all β [`(p'p and` $\beta]$ is false. We cannot yet calculate a set where for all β, `(p'p and` β is true. The constraint then demands that:

(68) For all $p: \ \{w \in C \mid \forall\beta: \ (p'p \ and \ \beta$ is false in $w\} \subseteq \{w \ inC \mid (p \ and \ \beta$ is false in $w\}$

[59] More explicitly: Suppose the set of worlds such that $([p'D] \ \beta$ is true for all β is non-empty. Then it contains a world $w \in C$ such that for any β, $([p'D] \ \beta$ is true. But consider the case where β is of the form `and` $\bot)$, where $\bot$ is a contradiction. The resulting sentence is not true in any world, hence it's not true in w. But this contradicts our assumption that w is a world where for all β, $([p'D] \ \beta$ is true. Hence $\{w \in C \mid$ for all $\beta: \ (p'p \ \beta$ is true in $w\}$ must be empty. Parallel reasoning holds for $\{w \in C \mid$ for all $\beta: \ (p'p \ \beta$ is false in $w\}$, only this time take β to be `or` $\top)$, where $\top$ is a tautology.

Since we are assuming that $Transparency_{LS}$ is satisfied, the above must hold for $p = \top$. In this case, the sets above can be re-written as:

(69) $\{w \in C \mid p' = 0 \textit{ or } \top = 0\} \subseteq \{w \in C \mid \top = 0\}$

A tautology is never false, so we have:

(70) $\{w \in C \mid p' = 0\} \subseteq \emptyset$

This is satisfied just in case there are no worlds in the context where $p' = 0$, i.e. all the worlds in C must be p'-worlds. So, since we are assuming that $Transparency_{LS}$ is satisfied, this must hold. We can then move to $\kappa = \textit{and } q$.

$\kappa = \textit{and } q$. At this point we know where S is both true and false. So, $Transparency_{LS}$ requires:

- For all p: $\{w \mid p' = 1 \textit{ and } p = 1 \textit{ and } q = 1\} \subseteq \{w \mid p = 1 \textit{ and } q = 1\}$
- For all p: $\{w \mid p' = 0 \textit{ or } p = 0 \textit{ or } q = 0\} \subseteq \{w \mid p = 0 \textit{ or } q = 0\}$

The first condition is satisfied automatically. The second condition also holds given that we have no worlds where $p' = 0$ in the context. The last κ we can consider is $\kappa = \textit{and } q)$. This is just like $\kappa = \textit{and } q$.

For the converse, suppose that $C \models p'$. Then, when $\kappa = \textit{and}$, we require that:

(71) For all p: $\{w \in C \mid p' = 0 \textit{ or } p = 0\} \subseteq \{w \in C \mid p = 0\}$

Since we are assuming that there are no worlds where $p' = 0$, we can re-write this as:

(72) For all p: $\{w \in C \mid p = 0\} \subseteq \{w \in C \mid p = 0\}$

This is clearly the case for all p. As we have seen, subsequent κ do not lead to any violation as long as $C \models p'$. So ($p'pand\ q$) satisfies $Transparency_{LS}$ iff $C \models p'$. In other words, it presupposes p'. Note that this requirement is imposed regardless of the second conjunct: unless it holds $Transparency_{LS}$ will be violated for $\kappa =$ `(p'p and` which is a point that will always be considered in testing whether ($p'p\ and\ q$) satisfies $Transparency_{LS}$, no matter what the second conjunct is.

Fact 3.4.2. *(q and $p'p$) satisfies $Transparency_{LS}$ iff $C \models q \to p'$.*

Suppose that ($q\ and\ p'p$) satisfies $Transparency_{LS}$. This means that the following hold:

- For all p: $\{w \mid \forall\beta :\ (q\ and\ p'p\beta \text{ is true}\} \subseteq \{w \mid \forall\beta :\ (q\ and\ p\beta \text{ is true}\}$
- For all p: $\{w \mid \forall\beta :\ (q\ and\ p'p\beta \text{ is false}\} \subseteq \{w \mid \forall\beta :\ (q\ and\ p\beta \text{ is false}\}$

There is only one possible continuation, namely the closing parenthesis. So, we can re-write the above as follows:

- For all p: $\{w \mid q = 1\ and\ p = 1\ and\ p' = 1\} \subseteq \{w \mid q = 1\ and\ p = 1\}$
- For all p: $\{w \mid q = 0\ or\ p = 0\ or\ p' = 0\} \subseteq \{w \mid q = 0\ or\ p = 0\}$

The interesting case is the second one. Since we are assuming it holds, then it must hold for $p = \top$. We then have:

(73) $\{w \mid q = 0\ or\ p' = 0\} \subseteq \{w \mid q = 0\}$

This holds just in case all the words in the context where $p' = 0$ are worlds where $q = 0$. In other words $C \models \neg p' \to \neg q$, and by taking the contrapositive we have $C \models q \to p'$.

For the converse, suppose that $C \models q \to p'$. Then $Transparency_{LS}$ requires that:

- For all p: $\{w \mid q = 1\ and\ p = 1\ and\ p' = 1\} \subseteq \{w \mid q = 1\ and\ p = 1\}$

- For all p: $\{w \mid q = 0 \textit{ or } p = 0 \textit{ or } p' = 0\} \subseteq \{w \mid q = 0 \textit{ or } p = 0\}$

The first condition holds trivially, and the second follows from the $C \models q \rightarrow p'$ assumption.

Upshot: Filtering in conjunction is asymmetric. Presuppositions project from the first conjunct but are filtered in the second conjunct if entailed by the first conjunct.

3.4.3. Disjunction

Fact 3.4.3. *($p'p$ or q) satisfies Transparency$_{LS}$ iff $C \models \neg q \rightarrow p'$.*

Suppose that ($p'p$ *or* q) satisfies *Transparency$_{LS}$* . Just like with conjunction, the *Transparency$_{LS}$* constraint becomes operative once the comprehender gets access to ($p'p$. So, we need to check that for all κ that continue the sentence, ($p'p$ κ the constraint is satisfied. Non-empty sets of worlds where ($p'p$ κ is true/false can only be computed once κ includes *or*. So we have:

`(p'p or` At this point we know that the sentence is already true in all worlds where $p'p$ is true. We cannot yet determine a non-empty set of worlds where the sentence is already false. So, the constraint requires that:

(74) For all p: $\{w \mid p' = 1 \textit{ and } p = 1\} \subseteq \{w \mid p = 1\}$

This is clearly the case. The next κ we can check the constraint at is `or q`:

`(p'p or q` At this point we have access to words where the sentence is both true and false. The true ones are where $p'p$ is true or q is true, while the false ones are where $p'p$ is false and q is false. Accordingly, *Transparency$_{LS}$* requires the following:

(75) a. For all p: $\{w \mid (p' = 1 \textit{ and } p = 1) \textit{ or } q = 1\} \subseteq \{w \mid p = 1 \textit{ or } q = 1\}$

b. For all p: $\{w \mid (p' = 0 \textit{ or } p = 0) \textit{ and } q = 0\} \subseteq \{w \mid p = 0 \textit{ and } q = 0\}$

(75a) clearly holds. We are also assuming that (75b) holds. Then it also needs to hold for $p = \top$.

In this case the requirement becomes:

(76) $\{w \mid p' = 0 \ and \ q = 0\} \subseteq \emptyset$

For this to be the case, $\{w \mid p' = 0 \ and \ q = 0\}$ must be empty. In other words, $C \models (p' \ or \ q))$, which is equivalent to $C \models \neg q \rightarrow p'$.

The final κ is `or q)`. Clearly, this works in the same way as $\kappa =$ `or q`.

Now suppose that $C \models \neg q \rightarrow p'$. The only point at which *Transparency*$_{LS}$ might fail is `(p'p or q`, with respect to the requirement is (75b). But we have seen that as long as $C \models (p' \ or \ q)$, then the requirement holds; hence there is so κ that makes $(p'p \ \kappa$ fail the requirements imposed by *Transparency*$_{LS}$.

The reverse case of $(q \ or \ p'p)$ works the same way as $(p'p \ or \ q)$, as the reader can verify for themselves.

Upshot: Filtering in conjunction is symmetric. Presuppositions in both the first and second disjunct are filtered if entailed by the negation of the other disjunct.

3.4.4. Conditionals

We are now ready to take a look at some core conditional cases. We look at both antecedent-initial and antecedent-final conditionals.

Fact 3.4.4. *$(if \ p'p. \ q)$ satisfies Transparency$_{LS}$ iff $C \models p'$*

Suppose that *Transparency*$_{LS}$ is satisfied. Then it is satisfied at `(if p'p.` κ, for $\kappa = \epsilon$. Transparency$_{LS}$ requires:

(77) For all p: $\{w \mid p' = 0 \ or \ p = 0\} \subseteq \{w \mid p = 0\}$

Since we are assuming this holds, it needs to hold for $p = \top$. We can then rewrite the condition as:

(78) $\{w \mid p' = 0\} \subseteq \emptyset$

This holds iff there are no worlds in C where $p' = 0$, so $C \models p'$.

Now suppose that $C \models p'$. *Transparency$_{LS}$* cannot fail. We have already seen that if $C \models p'$ then the relevant condition is satisfied for `(if p'p.` The other relevant case is `(if p'p.  q`. The requirements are:

(79) a. For all p: $\{w \mid p' = 0 \text{ } or \text{ } p = 0 \text{ } or \text{ } q = 0\} \subseteq \{w \mid p = 0 \text{ } or \text{ } q = 0\}$

b. For all p: $\{w \mid p' = 1 \text{ } and \text{ } p = 1 \text{ } and \text{ } q = 0\} \subseteq \{w \mid p = 1 \text{ } and \text{ } q = 0\}$

Since there are no worlds where $p' = 0$, $\{w \mid p' = 0 \text{ } or \text{ } p = 0 \text{ } or \text{ } q = 0\} = \{w \mid p = 0 \text{ } or \text{ } q = 0\}$, which means that the first condition above is satisfied. The second condition is satisfied trivially. Therefore, we derive the classic result that the presupposition of the antecedent needs to be satisfied in the context.

Fact 3.4.5. *$(if\ q.\ p'p)$ satisfies Transparency$_{LS}$ iff $C \models q \rightarrow p'$.*

Assume that $(if\ q.\ p'p)$ satisfies Transparency$_{LS}$. Then *Transparency$_{LS}$* is satisfied at `(if q.  p'p` κ for $\kappa = \epsilon$. The constraints are:

(80) a. For all p: $\{w \mid (p' = 1 \text{ } and \text{ } p = 1) \text{ } or \text{ } q = 0\} \subseteq \{w \mid p = 1 \text{ } or \text{ } q = 0\}$

b. For all p: $\{w \mid (p' = 0 \text{ } or \text{ } p = 0) \text{ } and \text{ } q = 1\} \subseteq \{w \mid p = 0 \text{ } and \text{ } q = 1\}$

The first of these conditions is satisfied trivially. For the second condition, since we are assuming it holds, it needs to hold for $p = \top$. Then, the condition can be rewritten as:

(81) For all p: $\{w \mid p' = 0 \textit{ and } q = 1\} \subseteq \emptyset$

This will hold just in case $C \models \neg p' \rightarrow q$, which is equivalent to $C \models \neg q \vee p'$, which is equivalent to $C \models q \rightarrow p'$. This derives the classic filtering conditions of a conditional: the presupposition in the consequent gets filtered if entailed by the antecedent.

Fact 3.4.6. *$(q.\ if\ p'p)$ satisfies $Transparency_{LS}$ iff* $C \models \neg q \rightarrow p'$

The place where the constraint becomes operative is at `(q. if p'p`. At this point, the requirements imposed are:

(82) a. For all p: $\{w \mid p' = 0 \textit{ or } p = 0 \textit{ or } q = 1\} \subseteq \{w \mid p = 0 \textit{ or } q = 1\}$

b. For all p: $\{w \mid p' = 1 \textit{ and } p = 1 \textit{ and } q = 0\} \subseteq \{w \mid p = 1 \textit{ and } q = 0\}$

These are exactly the requirements imposed by symmetric Transparency on $(q.\ if\ p'p)$, which we know are satisfied iff $C \models \neg q \rightarrow p'$

3.4.5. The effects of negation

3.4.5.1. What does a negated sentence presuppose?

A general feature of System 1 is the following proposition:

Proposition 3.4.1. *For all sentences A, A respects $Transp_{LS}$ iff $(not\ A)$ respects $Transp_{LS}$.*

To see this, suppose that A respects $Transparency_{LS}$. Then for all $p'p$, for all κ such that $\alpha\ p'p\ \kappa$ is an initial substring of A:

- For all p: $\{w \mid \forall\beta :\ \alpha\ p'p\kappa\ \beta \text{ is true}\} \subseteq \{w \mid \forall\beta :\ \alpha\ p\kappa\ \beta \text{ is true}\}$

- For all p: $\{w \mid \forall\beta :\ \alpha\ p'p\kappa\ \beta \text{ is false}\} \subseteq \{w \mid \forall\beta :\ \alpha\ p\kappa\ \beta \text{ is false}\}$

Now consider $(not\ A)$. It's easy to see that all for every β such that $\alpha\ p'p\ \beta$ is true, $(not\ \alpha\ p'p\ \beta)$ is false (and hence $(not\ A)$ is false). Set $\alpha' = (not\ \alpha$ (thus α' is an initial substring of $(not\ A)$).

Then then for all $p'p$, for all κ, it holds that:

- For all p: $\{w \mid \forall\beta : \ \alpha' \ p'p\kappa \ \beta \text{ is false}\} \subseteq \{w \mid \forall\beta : \ \alpha' \ p\kappa \ \ \beta \text{ is false}\}$

Similar reasoning derives that:

- For all p: $\{w \mid \forall\beta : \ \alpha' \ p'p\kappa \ \beta \text{ is true}\} \subseteq \{w \mid \forall\beta : \ \alpha' \ p\kappa \ \beta \text{ is true}\}$

Thus, it can be seen that A and (*not* A) satisfy $\mathit{Transparency}_{LS}$ under the same conditions, with the twist that the conditions that A imposes on the worlds where it's true are the conditions that (*not* A) imposes on the worlds where it's false (and similarly for the true case).

3.4.5.2. Further consequences

In view of the discussion above, it's interesting to consider the following possibility. Suppose that we have a sentence A such that for every initial substring $\alpha p'p$ of A, for all κ, for all p:

(83) $\{w|\forall\beta : \ \alpha p'p \ \kappa \ \beta \text{ is false in } w\} \subseteq \{w|\forall\beta : \ \alpha p \ \kappa \ \beta \text{ is false in } w\}$

However, for some κ and some p:

(84) $\{w|\forall\beta : \ \alpha p'p \ \kappa \ \beta \text{ is true in } w\} \not\subseteq \{w|\forall\beta : \ \alpha p \ \kappa \ \beta \text{ is true in } w\}$

Now suppose that A appears as the left argument in a conjunction (A *and* B). Because of the property in (83), at parsing point `(A and`, there will be no violation of $\mathit{Transparency}_{LS}$. Therefore, if any violations exist, they will happen after the comprehender has already started parsing part of B. As we will see in more detail below, this makes it possible for material in B to help with filtering presuppositions in A.

Conversely, if A were to appear as the left disjunct in a sentence like (A *or* B), then the property in (84) could lead to a violation of $\mathit{Transparency}_{LS}$. Such an outcome would come about in the case where the $\alpha \ p'p \ \kappa$ string in (84) is equal to A.

For the rest of this section, we examine how negation can land us in cases of exactly this sort, producing cases of symmetric filtering in certain kinds of conjunctions and conditionals, but also cases of asymmetric disjunction.

Symmetric conjunction The following fact provides us with a recipe for constructing symmetric conjunctions:

Fact 3.4.7. *$S = ((not\ A)\ and\ (not\ B))$ respects $Transparency_{LS}$ in C iff $S' = (A\ or\ B)$ respects $Transparency_{LS}$ iff $(not\ (A\ or\ B))$ respects $Transparency_{LS}$ in C.*

To see this, suppose first that S respects $Transparency_{LS}$ in C. Then the following hold:[60]

(85)

- For every $p'p$ in A, for every p:

  $-\{w|\ A$ is true in $w\} \subseteq \{w|\ A_{p'p/p}$ is true in $w\}$

- For every $p'p$ in A, for every initial string κ of B, for every p:

  $-\{w|\ \forall\beta:\ A$ is false in w *and* $\kappa\beta$ is false in $w\} \subseteq$

  $-\{w|\ \forall\beta:\ A_{p'p/p}$ is false in w *and* $\kappa\beta$ is false in $w\}$

- For every $p'p$ in A, for every initial string κ of B, for every p:

  $-\{w|\ \forall\beta:\ A$ is true in w *or* $\kappa\beta$ is true in $w\} \subseteq$

  $-\{w|\ \forall\beta:\ A_{p'p/p}$ is true in w *or* $\kappa\beta$ is true in $w\}$

- For every $p'p$ in B, for every initial string κ of B, for every p:

  $-\{w|\ \forall\beta:\ A$ is false in w *and* $\kappa\beta$ is false in $w\} \subseteq$

  $-\{w|\ \forall\beta:\ A$ is false in w *and* $[\kappa\beta]_{p'p/p}$ is false in $w\}$

- For every $p'p$ in A, for every initial string κ of B, for every p:

  $-\{w|\ \forall\beta:\ A$ is true in w *or* $\kappa\beta$ is true in $w\} \subseteq$

  $-\{w|\ \forall\beta:\ A$ is true in w *or* $[\kappa\beta]_{p'p/p}$ is true in $w\}$

[60] To get an intuitive sense of why the following bullet points hold, imagine parsing `((not A) and (not B)` symbol by symbol, trying to find points where we know that the sentence is already true or already false. The first such point occurs when we parse the highest connective (in this case 'and'). Subsequent such points occur when we have parsed enough of `(not B)` to be able to compute worlds where `(not B)` is already true/false. It is at these points that *$Transparency_{LS}$* can meaningfully be checked, and that is why the bullet points below focus on those points.

If any of these bullet points is violated, then we can show that S doesn't satisfy $\mathit{Transparency}_{LS}$ in C, contrary to assumption. As an illustration, suppose that the fourth bullet point is false. Then, for some $p'p$ in B, for some initial string of B κ and for some p:

(86) $\{w|\ \forall\beta:\ A$ is false in w *and* $\kappa\beta$ is false in $w\} \not\subseteq$

$\{w|\ \forall\beta:\ A$ is false in w *and* $[\kappa\beta]_{p'p/p}$ is false in $w\}$

Note that κ has to include $p'p$. If it doesn't, then $\kappa\beta$ is the same sentence as $[\kappa\beta]_{p'p/p}$ (by the definition of substitution), and hence the two sets above should be equal, contrary to assumption. Therefore, κ can be decomposed into $\kappa = \kappa'\ p'p\ \lambda$ (with κ', λ possibly being the empty string). Therefore, (86) above can be re-written as:

(87) $\{w|\ \forall\beta:\ A$ is false in w *and* $[\kappa'\ p'p\ \lambda]\beta$ is false in $w\} \not\subseteq$

$\{w|\ \forall\beta:\ A$ is false in w *and* $[\kappa'\ p\ \lambda]\beta$ is false in $w\}$

Now consider the substring $\sigma =$ `((not A) and (not` κ' `p'p`. $\mathit{Transparency}_{LS}$ requires that for every μ such that `((not A) and (not` κ' `p'p` μ is a substring of S:

(88) $\{w\ |\forall\beta:\ ((\mathit{not}\ A)\ \mathit{and}\ (\mathit{not}\ \kappa'\ p'p\ \mu\ \beta$ is true$\} \subseteq \{w\ |\forall\beta:\ ((\mathit{not}\ A)\ \mathit{and}\ (\mathit{not}\ \kappa'\ p\ \mu\ \beta$ is true$\}$

By the truth conditions of S, this last subsethood condition is equivalent to:

(89) $\{w|\ \forall\beta:\ A$ is false in w *and* $[\kappa'\ p'p\ \mu]\beta$ is false in $w\} \subseteq$

$\{w|\ \forall\beta:\ A$ is false in w *and* $[\kappa'\ p\ \mu]\beta$ is false in $w\}$

But from (87), we know that this fails for $\mu = \lambda$ and for some p. Therefore, $\mathit{Transparency}_{LS}$ doesn't hold, which contradicts our original assumption. Assuming that any of the other bullet points here fail leads to violations of $Transparency_{LS}$ along similar lines.

Moreover, if we assume that $Transparency_{LS}$ fails for S in C, then every way in which such a failure can occur leads to one of the bullet points in (85) failing. This means that S satisfies $Transparency_{LS}$ in S iff the bullet points in (85) hold.

Reasoning in a similar fashion as above, it can be shown that S' satisfied $Transparency_{LS}$ in C iff the conditions in (85) hold. And by application of Proposition 1, the conditions in (85) hold iff $(not\ (A\ or\ B))$ satisfies $Transparency_{LS}$ in C.

How can this give us symmetric conjunctions? We saw earlier that $(p'p\ or\ q)$ respects $Transparency_{LS}$ iff $C \models \neg q \to p'$. The above fact tells us that $[(not\ p'p)\ and\ (not\ q)]$ also respects $Transparency_{LS}$ iff $C \models \neg q \to p'$.

Furthermore, if we think of $[(not\ p'p)\ and\ q]$ as $[(not\ p'p)\ and\ (not\ (not\ q))]$, then this will satisfy $Transparency_{LS}$ iff $[(p'p\ or\ (not\ q))]$ satisfies $Transparency_{LS}$. The latter happens just in case $C \models q \to p'$. Therefore, the presupposition of the first conjunct in $[(not\ p'p)\ and\ q]$ is filtered if entailed by the second conjunct.

Therefore, we can have symmetric conjunction where the presupposition p' in the first conjunct does not project to the global level, but instead can be filtered by the second conjunct (under appropriate circumstances). Interestingly, this continues to hold if the $((not\ p'p)\ and\ (q))$ is embedded in the antecedent of a conditional (we omit the derivation here):

Fact 3.4.8. *$(if\ ((not\ p'p)\ and\ q).\ r)$ presupposes $C \models (q \wedge r) \to p'$.*

Asymmetric disjunction On the other end of the (a-)symmetry spectrum, we can have disjunction that behave like conjunctions, with the following fact providing a recipe for getting asymmetric disjunctions:

Fact 3.4.9. *$S = ((not\ A)\ or\ (not\ B))$ satisfies $Transparency_{LS}$ in C iff $S' = (A\ and\ B)$ satisfies $Transparency_{LS}$ in C iff $(not\ (A\ and\ B))$ satisfies$Transparency_{LS}$ in C.*

The reasoning behind this is parallel to Fact 4.6. Suppose that S satisfies $\mathit{Transparency}_{LS}$ in C. Then, the following conditions hold:

(90)
- For every $p'p$ in A, for every p:
  - $\{w|\ A$ is false in $w\} \subseteq \{w|\ A_{p'p/p}$ is false in $w\}$
- For every $p'p$ in A, for every initial string κ of B, for every p:
  - $\{w|\ \forall\beta:\ A$ is false in w *or* $\kappa\beta$ is false in $w\} \subseteq$
  - $\{w|\ \forall\beta:\ A_{p'p/p}$ is false in w *or* $\kappa\beta$ is false in $w\}$
- For every $p'p$ in A, for every initial string κ of B, for every p:
  - $\{w|\ \forall\beta:\ A$ is true in w *and* $\kappa\beta$ is true in $w\} \subseteq$
  - $\{w|\ \forall\beta:\ A_{p'p/p}$ is true in w *and* $\kappa\beta$ is true in $w\}$
- For every $p'p$ in B, for every initial string κ of B, for every p:
  - $\{w|\ \forall\beta:\ A$ is false in w *or* $\kappa\beta$ is false in $w\} \subseteq$
  - $\{w|\ \forall\beta:\ A$ is false in w *or* $[\kappa\beta]_{p'p/p}$ is false in $w\}$
- For every $p'p$ in A, for every initial string κ of B, for every p:
  - $\{w|\ \forall\beta:\ A$ is true in w *and* $\kappa\beta$ is true in $w\} \subseteq$
  - $\{w|\ \forall\beta:\ A$ is true in w *and* $[\kappa\beta]_{p'p/p}$ is true in $w\}$

It's also the case that if S doesn't satisfy $\mathit{Transparency}_{LS}$, then one of the conditions in (90) fails. So S satisfies $\mathit{Transparency}_{LS}$ iff the conditions in (90) hold. Similarly, S' satisfies $\mathit{Transparency}_{LS}$ iff the conditions in (90) hold. The final equivalence in the Fact follows by applying Proposition 4.1.

For example ((*not* $p'p$) *or* (*not* q)) imposes the requirement that $C \models p'$ just like ($p'p$ *and* q). Interestingly, this doesn't continue to hold if the ((*not* $p'p$) *or* (*not* q)) is embedded in the antecedent of a conditional: (if ((*not* $p'p$) *or* (*not* q)). r) presupposes that $C \models (q \vee r) \rightarrow (p' \vee r)$, whereas ($if$ ($p'p$ *and* q). r) presupposes that $C \models p'$.

Symmetric conditionals Finally, even though we have seen cases where a presupposition in the antecedent of a conditional leads to presuppositional requirement on the global context, we can have conditionals with a more 'symmetric' profile by making careful use of negations:

Fact 3.4.10. *$(if\ (not\ p'p).\ q)$ respects $Transparency_{LS}$ iff $(p'p\ or\ q)$ respects $Transparency_{LS}$.*

To see why, consider the following: the first point where a comprehender can reason about the truth/falsity of this sentence is `(if (not p'p).` At this point, all we know is that the sentence is true in $\{w \mid p' = 1\ and\ p = 1\}$. It's easy to see that for all p: $\{w \mid p' = 1\ and\ p = 1\} \subseteq \{w \mid p = 1\}$.

Moving on, the parser gets access to q. Then we can reason about the case where the sentence is false: $\{w \mid (p' = 0\ or\ p = 0)\ and\ q = 0\}$. The condition imposed by $Transparency_{LS}$ is that for all p:

(91) $\{w \mid (p' = 0\ or\ p = 0)\ and\ q = 0\} \subseteq \{w \mid p = 0\ and\ q = 0\}$

For this to hold, it needs to be the case that context contains no worlds where $p' = 0$ and $q = 0$, i.e. it needs to hold that $C \models p' \vee q$, which is equivalent to $C \models \neg q \rightarrow p'$. This is the presupposition that, as we saw earlier, a disjunction of the form $(p'p\ or\ q)$ has.

It is not generally the case that $(if\ (not\ A).\ B)$ respects $Transparency_{LS}$ in C iff $(A\ or\ B)$ respects $Transparency_{LS}$ in C.[61]

A counterexample is $(if\ not\ ((not\ p'p)\ or\ q).\ r)$. The first point where comprehenders can reason about truth/falsity is `(if not ((not p'p) or` as at this point the conditional is already true in worlds where $(not\ p'p)$ is true. Thus for all p, it must hold:

(92) $\{w \mid p' = 0\ or\ p = 0\} \subseteq \{w \mid p = 0\}$

As we have seen enough times so far, this holds iff $C \models p'$. Consider now $(((not\ p'p)\ or\ q)\ or\ r)$.

[61] Although this would hold if we had used infix notation for the conditional (e.g. $A \rightarrow B$) as in that case the comprehender would have to parse A in is entirety before they can calculate where the conditional is true regardless of continuation, just like the a disjunction of the form $(A\ or\ B)$.

The first point where comprehenders can reason about truth/falsity is `(((not p’p) or q) or .` The sentence is already true in worlds where $p'p$ is false or q is true. Thus, it must hold that for all p:

(93) $\{w|\ p' = 0\ or\ p = 0\ or\ q = 1\} \subseteq \{w|\ p = 0\ or\ q = 1\}$

This holds for all p iff $\neg p'$ worlds are also q worlds, i.e. iff $C \models \neg q \rightarrow p'$.

3.4.6. Multiple Triggers

Fact 3.4.11. *($p'p$ and $q'q$) presupposes $C \models p'$.*

This follows simply from the asymmetry of conjunction in the system. At parsing point `(p’p  and` the constraint requires that:

(94) For all p: $\{w|\ p' = 0\ or\ p = 0\} \subseteq \{w|\ p = 0\}$

As we have seen, this holds just in case $C \models p'$.

Fact 3.4.12. *((not $p'p$) and $q'q$) presupposes $C \models q'q \rightarrow p'$ and $C \models p'p \rightarrow q'$.*

Again, this simply follows from the symmetry of negated conjunctions. We know that at the point when `((not p’p) and` is reached, the constraint is not violated. The comprehender then moves on to `((not p’p) and q’q`. The constraint then requires:

(95) For all p:

a. $\{w|\ (p' = 0\ and\ q' = 1\ and\ q = 1)\ or\ (p = 0\ and\ q' = 1\ and\ q = 1)\} \subseteq \{w|\ p = 0\ and\ q' = 1\ and\ q = 1)\}$

b. $\{w|\ (p' = 1\ and\ p = 1)\ or\ q' = 0\ or\ q = 0\} \subseteq \{w|\ p = 1\ or\ q' = 0\ or\ q = 0\}$

The constraint holds in the case of (95b). In the case of (95a), it holds iff $C \models p' \vee \neg q' \vee \neg q$, which is equivalent to $C \models q'q \to p'$. Similar kind of reasoning leads to the conclusion that the constraint applied with respect to $q'q$ is satisfied just in case $C \models p'p \to q'$.

Fact 3.4.13. *($p'p$ or $q'q$), presupposes $C \models ((p'$ or $q'q)$ and $(q'$ or $p'p))$.*

This works just like the case of symmetric Transparency that we reviewed in section 2.2.4. When $p' = \neg q'$, the presupposition becomes $C \models (p'p$ *or* $q'q)$.

Fact 3.4.14. *($(\neg p'p)$ or $q'q$), presupposes $C \models p'$.*

This follows from the asymmetry of negated disjunctions that we examined earlier.

3.4.7. Linearity effects

A final, and important, aspect of *Limited Symmetry* is the fact that it operates incrementally on strings. One consequence of this is that no real computations can start taking place before one has encountered the highest connective in a sentence S, as it is that connective that gives information about where the whole sentence has the chance of being true/false regardless of continuation. This means that all the information one has encountered during the parse of S from left to right until the highest connective is reached will be fair game in trying to build the equivalence required by Transparency. This can lead to cases of symmetric filtering when sequences of 'presupposition trigger + filtering material' are to be found before the highest connective of the sentence. For example, the following fact holds:

Fact 3.4.15. *($(p'p$ and $q)$ or r) presupposes $C \models q \to (p' \vee r)$.*

The first point where we can reason about the truth/falsity of the sentence is `((p'p and q) or`. Then we know that the sentence is already true in worlds that make the first disjunct true. So, the constraint demands that:

(96) For all p: $\{w |\ p' = 1$ *and* $p = 1$ *and* $q = 1\} \subseteq \{w |\ p = 1$ *and* $q = 1\}$

This clearly holds. The parse moves on to `((p'p and q) or q`. The interesting case is the false worlds:

(97) For all p: $\{w|\ (p' = 0\ or\ p = 0\ or\ q = 0)\ and\ r = 0\} \subseteq \{w|\ (p = 0\ or\ q = 0)\ and\ r = 0\}$

This needs to hold for all p, so it needs to hold for the case where $p = \top$. Then, the constraint becomes:

(98) For all p: $\{w|\ (p' = 0\ or\ q = 0)\ and\ r = 0\} \subseteq \{w|\ q = 0\ and\ r = 0\}$

This holds just in case all the worlds where $p' = 0$ and $r = 0$ are worlds where $q = 0$. In other worlds, it holds just in case $C \models q \to (p' \vee r)$. Conversely, if $C \models q \to (p' \vee r)$, then (97) will hold.

Thus, if the second conjunct here entails the presupposition of the first conjunct, then condition we derived will be satisfied. Note that the other possibility that obviates the violation of *Transparency*$_{LS}$ in this example, namely that $q \models r$, is blocked due to Hurford's constraint, (Hurford, 1974); in this case the first disjunct would entail the second disjunct, in clear violation of said constraint.

3.4.8. A note on accommodation

If one wanted to handle accommodation phenomena in *System 1* (or *System 2* later), one could import the way accommodation is handled in Transparency. Global accommodation just means changing the global context to contain the necessary information. Local accommodation can be handled as the non-application of Transparency$_{LS}$, taking a sentence like $S(p'p)$ to be understood as $S(p'\ and\ p)$ by comprehenders. As accommodation phenomena are not our current focus here, we will not expand on the topic beyond the current note.[62]

[62] One possibility to consider for future research is the following: in a *Limited Symmetry* kind of system, one is essentially walking through a sentence symbol-by-symbol from the left to right. At every point one considers where in the context the sentence is already true/false regardless of continuation. It is conceivable that comprehenders locally discard subsets of the context where the truth/falsity of the sentence has been determined (this is the idea behind Schlenker's local contexts, Schlenker 2009). One could then try and see if a notion of local accommodation

3.4.9. Empirical outlook

Basic overview It is clear by this point that the approach underlying *Limited Symmetry* is highly predictive. Given a sentence, one can go through all the points where truth and falsity can be (perhaps partially) computed, and reason about what happens to the sentence when presuppositional constants are included or taken out, and check if the result conforms to the conditions imposed by *Limited Symmetry.* The core success of our approach is the derivation of **asymmetric** conjunction, but **symmetric disjunction**, at least in simple cases, through a single mechanism. Moreover, antecedent-initial conditionals project the presuppositions of their antecedent, while antecedent final conditionals are associated with a conditional presupposition. This captures the contrast found in Schwarz 2015, without at the same time predicting that antecedent initial conditionals should show costly access to such a conditional presupposition.

Negation The empirically interesting part of the predictions of *System 1* arises when negation is involved. We saw that in conditionals with a negated antecedent, symmetry is predicted in that the negation of the antecedent is predicted to be able to filter a presupposition in the antecedent. The data as we reviewed them in section 2 are not clear on this point. While some triggers intuitively exhibit the requisite symmetry, others appear more recalcitrant in that respect.

A full empirical study would be needed to get a better idea of what's going on in cases like this, but taking the above data points at face value for the moment, it looks like at least some triggers (like *continue*) do not behave as System 1 would predict. Possibilities as to why are that in fact filtering in conditionals is always asymmetric, with 'symmetric' cases being the result of local accommodation; or that there is a split between triggers with some showing symmetry, while others don't. In the second case, it would be interesting to test whether the class of triggers that do show symmetry pattern with *System 1* along other dimensions as well. Also, if there is such a split, one would ideally want to find a criterion for individuating these triggers that goes beyond just 'these triggers follow the predictions of *System 1*, whereas those triggers do not'. In the absence of data, all this remains of course at the level of speculation.

as "addition of information to a local context" can be recovered in that way. I leave further investigation of this for the future.

Other cases where System 1 makes interesting empirical predictions with respect to negation are even harder to get an intuitive sense of: these are the negated conjunction/disjunction cases discussed earlier. The prediction is that negating the disjuncts of a bathroom disjunctions should produce a symmetric conjunctions, while negating the conjuncts of an asymmetric conjunctions should produce an asymmetric disjunction. Starting from the asymmetric disjunction case, the prediction is that (99c) should be infelicitous, contrasting with the felicitous (99b):

(99) a. There's a new show at the theater. We see John outside the theater, but it's not clear if he's attending the performance, and we have no idea if he has gone to any of the previous performances of this new show.

b. (? ✗) Either John is not going to the new show again, or he hasn't been to the new show so far.

c. (? ✓) Either John is going to the new show again or he hasn't been to the new show so far.

The test cases for symmetric conjunction are even more complicated, since a simple conjunction cannot be presented in an explicit ignorance context without some kind of embedding. Nevertheless, the symmetry prediction is preserved if the conjunction is embedded in the antecedent of a conditional (see section 4.5.2). It is interesting to recall at this point the negated conjunction examples claimed to be symmetric by Rothschild:

(100) If John doesn't know it's raining and it is raining, then John will be surprised when he walks outside.

This is exactly what our approach predicts. However, other cases are less clear to judge. For example, we predict that (101b) should be felicitous, contrasting with the infelicitous (101c):

(101) a. **Context:** There's a new show at the theater. John likes attending the performances, often on Monday evening, and occasionally going to some of them more than once. The other day, I saw John doing some shopping very close to the theater. I have no idea if he has attended the new show at all, but I thought:

b. (? ✓) If John is not going to the new show again, and he went to the new show on Monday, then he was just shopping.

c. (? ✗) If John is going to the new show again, and he went to the new show on Monday, then he wasn't just shopping.

Getting clear intuitive judgments about complicated conjunctions and disjunctions like the above is not easy, and the matter is best settled through detailed empirical studies of the sort undertaken in Kalomoiros & Schwarz 2021 (see also chapter 5). One possibility to keep in mind (apart from the obvious that the approach might turn out to be wrong across the board) is the following: it's possible that the predicted patterns might be substantiated for one class of triggers, but not for another (cf. the discussion about conditionals with negated antecedents above; see also chapter 5 for experimental work pointing towards such a mixed picture).

Multiple triggers In terms of multiple triggers, we make the same predictions as symmetric Transparency for the case of conflicting presuppositions. $(p'p \textit{ or } q'q)$ where $p' = \neg q'$ presupposes $C \models (p'p \textit{ or } q'q)$.

At the same time, we avoid some cases of entailing triggers that were problematic for symmetric Transparency. For instance, the following are predicted to presuppose that John used to smoke:

(102) a. John stopped smoking and he regrets that he used to smoke.

b. Either John didn't stop smoking or he doesn't regret that he used to smoke.

However, recall that we can make a conjunction symmetric, by negating the first conjunct. Therefore, as shown in section 4.6, the following is predicted to carry no presuppositions:[63]

(103) John didn't stop smoking and he regrets that he used to smoke.

(103) does appear to carry a presupposition that John used to smoke.[64]

Linearity We also discussed the possibility of 'linearity effects' arising essentially from the fact that nothing is really possible in terms of violations of $\mathit{Transparency}_{LS}$ unless the parse reaches the highest connective in the sentence. The case we examined predicted that disjunction like the following should exhibit filtering:

(104) a. **Context:** We see that John has set down his name for a study that involves former smokers of Marlboro cigarettes. We have no idea if he ever smoked, so we think:

b. Either John stopped smoking and used to smoke Marlboros, or he entered the study by mistake.

This is another interesting prediction as it really sets apart this type of model from algorithms that proceed compositionally on the structure of the sentence (like Strong/Middle Kleene and Dynamic Semantics). In those approaches, the first disjunct would be required to obey whatever rule conjunctions generally obey in the system. Assuming a system where conjunction is asymmetric, this would predict that the first disjunct carries the presupposition that 'John used to smoke'. If the system also has a symmetric disjunction, then this presupposition can only be filtered if the negation of the second disjunct entails it. As this is not the case in (104b), the presupposition is

[63] Note that it doesn't make sense to construct problematic disjunctions by taking the first disjunct to be unnegated:

(i) Either John stopped smoking or he doesn't regret that he used to smoke.

The second disjunct can filter the presupposition of the first disjunct; but the first disjunct cannot filter the presupposition of the second disjunct, since it must be **the negation** of the first disjunct that entails the presuppositions of the second disjunct.

[64] One option here is to move to Schlenker's solution for cases of this kind (see fn 52), where the Transparency constraint is evaluated with respect to to the non-presuppositional components of the sentence.

predicted to project, and come into conflict with the context.

Summary The predictive power of the approach is clear. The core predictions (excluding multiple triggers) are summarized in the following table:

Sentence	System 1
$(p'p\ and\ q)$	$C \models p'$
$((\neg p'p)\ and\ q)$	$C \models q \rightarrow p'$
$(p'p\ or\ q)$	$C \models \neg q \rightarrow p'$
$((\neg p'p)\ or\ q)$	$C \models p'$
$(if\ p'p.\ q)$	$C \models p'$
$(q.\ if\ p'p)$	$C \models \neg q \rightarrow p'$
$(if\ (not\ p'p).\ q)$	$C \models \neg q \rightarrow p'$
$\neg(p'p\ and\ q)$	$C \models p'$
$((p'p\ and\ q)\ or\ r)$	$C \models q \rightarrow (p' \vee r)$

Table 3.11: Summary core predictions for System 1

At the same time, it's not clear that all the novel predictions it makes are substantiated across the board, and we suggested the possibility that perhaps only a subclass of triggers might be patterning like *System 1* predicts (exactly which is largely an empirical question).

At any rate, given that the results for symmetric disjunction investigated empirically in Kalomoiros & Schwarz 2021 were based on a wide variety of triggers, including both *again* and *stop*, it seems desirable to investigate a version of *Limited Symmetry* where the basic intuition underlying the symmetry of disjunctions is retained, but inserting negations doesn't flip (a-)symmetries in the way predicted by *System 1*. We turn to the instigation of such a system, dubbed *System 2*, in the next section.

3.5. Limited Symmetry: System 2

3.5.1. Basic ideas and definitions

The basic language is kept as in section 4.1. What does change is the semantics. Since we want *System 2* to incorporate a semantic notion of presupposition, we move the basic semantics to a trivalent setting. Our language will be as before, with the difference now being that $p'p$ is undefined in worlds where p' is false. The rest of the semantics will depend on a recipe of how undefinedness percolates up the structure of sentences. Assume for the moment that this is given by the Strong Kleene system.

The core idea remains the same: comprehenders are categorizing worlds in a context C as they are interpreting a sentence S incrementally. However, now they have three truth values to juggle. A natural way to extend the cetegorization idea in the case of trivalence is to take comprehenders to be categorizing worlds into true vs non-true, where non-truth encompasses falsity and undefinedness. Let's call the worlds where S is true, *worlds where S is accepted*, and the worlds where S is false or undefined *worlds where S is rejected*

The basic idea underlying presupposition failure remains the same: for every $p'p$ sentence in S (i.e. for every sentence capable for introducing the # value in the semantics), the version of S with p' removed should not lead to any differences in terms of what worlds are accepted or rejected as S is parsed from left to right. Simplifying a little, while a world is in principle acceptable/rejectable due to the effects of #, it should not be acceptable/rejectable solely on that basis (otherwise we have presupposition failure). Then we can restate the *Limited Symmetry* constraint as follows:

Definition 3.5.1. Transparency$_{LS}$ (*System 2*)

For all sentences S, for all contexts C: If S begins with a substring of the form $\alpha\ p'p$, then S is acceptable in C iff for all κ such that $\alpha p'p\ \kappa$ is a substring of S, it holds that:

- For all p: $\{w \in C \mid \forall\beta : \alpha\ p'p\ \kappa\ \beta \text{ is accepted in } w\} \subseteq \{w \in C \mid \forall\beta : \alpha\ p\ \kappa\ \beta \text{ is accepted in } w\}$

- For all p: $\{w \in C \mid \forall\beta : \alpha\ p'p\ \kappa\ \beta$ is rejected in $w\} \subseteq \{w \in C \mid \forall\beta : \alpha\ p\ \kappa\ \beta$ is rejected in $w\}$

As said above, when exactly a sentence receives the # value will depend on the choice of trivalent semantics. We will start with the Strong Kleene semantics, as it can already do quite a lot of work for our purposes. It will fail in the case of conditionals, at which point we will discuss some alternative that are open to us.

We now turn to applying the system to the basic cases of conjunction, disjunction and negation. We will then discuss conditionals, which will motivate the abandonment of the full Strong Kleene system.[65]

3.5.2. Conjunction

Fact 3.5.1. *A conjunction of the form* ($p'p$ *and* q) *respects Transparency*$_{LS}$ *iff* $C \models p'$.

Suppose that S = ($p'p$ *and* q) respects *Transparency*$_{LS}$. Then it must hold that for all p, all the worlds where the sentence is already rejected at the `(p'p and` point are worlds where $S_{p'p/p}$ is already rejected at the `(p and` point. According to the Strong Kleene table, if $p'p$ is false or undefined, then S will be false or undefined no matter then second argument of the conjunction. Therefore, the constraint requires that:

(105) For all p: $\{w \mid p' = 0$ *or* $p = 0\} \subseteq \{w \mid p = 0\}$

We know from previous examples that this holds just in case $C \models p'$. The other direction is again similar to the corresponding *System 1* example.

[65] A note on combining trivalent semantics with a Transparency-like constraint: the trivalent semantics that serves as the underlying logic is not meant to capture cases where a presupposition projects vs gets filtered. It is only a hypothesis about how undefinedness is handled in the semantics. The *Transparency*$_{LS}$ constraint is what **predicts** presupposition failure given the underlying semantics of logical connectives. In this sense, the system continues to obey the Schlenkerian injunction of finding an algorithm that predicts the projection properties of a connective once its underlying semantics has been specified. Only now, we are moving from bivalence to trivalence. In this sense, it also becomes explanatorily less pressing to have the underlying trivalence be *derived* from classical logic; since we do no use the trivalence in our system to **predict** projection, it escapes Schlenker's requirement that it be the part of the story that is derived rather than stipulated. Of course, an account along these lines that can also *justify* the choice of a particular trivalent system has a clear overall conceptual advantage.

Fact 3.5.2. *A conjunction of the form (q and $p'p$) respects Transparency$_{LS}$ iff $C \models q \rightarrow p'$.*

Suppose that (*q and* $p'p$) respects *Transparency$_{LS}$*. Then it must hold that for all p, all the worlds where the sentence is already rejected at the `(q and p'p` point are worlds where $S_{p'p/p}$ is already rejected at the `(q and p` point, i.e.:

(106) For all p: $\{w \mid q = 0 \textit{ or } p' = 0 \textit{ or } p = 0\} \subseteq \{w \mid q = 0 \textit{ or } p = 0\}$

We know from previous examples that this holds just in case $C \models q \rightarrow p'$. The other direction is again similar to the corresponding *System 1* example.

3.5.3. Disjunction

Fact 3.5.3. *A disjunction of the form ($p'p$ or q) respects Transparency$_{LS}$ iff $C \models \neg q \rightarrow p'$.*

Suppose that ($p'p$ *or* q) respects *Transparency$_{LS}$*. Then it must hold that for all p, all the worlds where the sentence is already accepted at the `(p'p or` point are worlds where $S_{p'p/p}$ is already accepted at the `(p or` point. For worlds where $p'p$ is false or undefined, the Strong Kleene table does not allow us to say that the sentence is false or undefined no matter the second argument, as the second argument could always be true, making the whole disjunction true. Therefore, the only nontrivial requirement at this point is:

(107) For all p: $\{w \mid p' = 1 \textit{ and } p = 1\} \subseteq \{w \mid p = 1\}$

This clearly holds. The next requirement that is that for all p, all of the worlds where `(p'p or q` is already accepted (rejected) must be worlds where `(p or q` is already accepted (rejected), i.e.:

(108) For all p: $\{w \mid (p' = 1 \textit{ and } p = 1) \textit{ or } q = 1\} \subseteq \{w \mid p = 1 \textit{ or } q = 1\}$

(109) For all p: $\{w \mid (p' = 0 \textit{ or } p = 0) \textit{ and } q = 0\} \subseteq \{w \mid p = 0 \textit{ and } q = 0\}$

These are the same requirements imposed on the same sentence by *System 1*. As we saw above, they hold just in case $c \models \neg q \to p'$. The other direction also follows the corresponding *System 1* example.

As is easily checked, $(q\ or\ p'p)$ also respects $Transparency_{LS}$ iff $C \models \neg q \to p'$.

3.5.4. Negation

The examples of *System 2* presented so far behave the same as the corresponding *System 1* cases. However things change dramatically when negation enters the picture, starting with the fact that Proposition 3.4.1 no longer holds: it's no longer true that a sentence A respects $Transparency_{LS}$ just in case $(not\ A)$ respects $Transparency_{LS}$. The following example confirms this:

Fact 3.5.4. *$(not\ (p'p\ and\ q))$ respects $Transparency_{LS}$ in a context C iff $C \models q \to p'$.*

This sentence is accepted in a world w iff $(p'p\ and\ q)$ is false in w, which happens iff $p' = 1$ and $p = 0$, or if $q = 0$. It is rejected if it is undefined or true in w, which happens iff $p' = 0$ and $q = 1$, or if $p' = 1$ and $p = 1$ and $q = 1$.

So assume that the sentence respects $Transparency_{LS}$. This means that when the comprehender has access just to `(not(p'p and`, they know a subset of the context where the sentence is accepted regardless of continuation, namely the set of worlds where $p' = 1$ and $p = 0$. The comprehender does not know yet any worlds where the sentence is rejected, as all such worlds make reference to q. The constraint then requires that:

(110) For all p: $\{w \mid p' = 1\ and\ p = 0\} \subseteq \{w \mid p = 0\}$

This is clearly the case. The comprehender then gets access to `(not(p'p and q`, the constraint requires the following:

(111) For all p: $\{w \mid (p' = 1\ and\ p = 0)\ or\ q = 0\} \subseteq \{w \mid p = 0\ or\ q = 0\}$

(112) For all p: $\{w \mid (p' = 1 \textit{ and } p = 1 \textit{ and } q = 1) \textit{ or } (p' = 0 \textit{ and } q = 1)\} \subseteq \{w \mid p = 1 \textit{ and } q = 1\}$

The first condition clearly holds. The second condition holds just in case $\{w \mid p' = 0 \textit{ and } q = 1\}$ is empty, that is just in case $C \models \neg q \vee p'$, which is equivalent to $C \models q \rightarrow p'$.

These conditions for satisfying $\textit{Transparency}_{LS}$ are not the same as the conditions that $(p'p \textit{ and } q)$ imposes, as we saw earlier. Therefore, it's not the case that a sentence and its negation always have equivalent presupposition in *System 2*.[66]

What the definition of acceptance/rejection does keep constant between a sentence A and its negation is the worlds where A and (*not* A) are rejected because of undefinedness. This becomes very important when reasoning about binary connectives where rejection of the left argument causes either acceptance or rejection of the entire sentence, as is the case with conjunction. Regardless of whether the left argument position in such cases is occupied by A or by (*not* A), the effect is the same, since all of the worlds where A is undefined will be worlds where the acceptance/rejection of the overall sentence is determined regardless of what the second argument is. To see this in action, we show how $((\textit{not } p'p) \textit{ and } q)$ satisfies $\textit{Transparency}_{LS}$ just in case $(p'p \textit{ and } q)$ satisfies $\textit{Transparency}_{LS}$, i.e. we show the following:

Fact 3.5.5. *$((\textit{not } p'p) \textit{ and } q)$ satisfies $\textit{Transparency}_{LS}$ in a context C iff $C \models p'$,*

Suppose that $((\textit{not } p'p) \textit{ and } q)$ satisfies $\textit{Transparency}_{LS}$ in C. One of the parsing points where the $\textit{Transparency}_{LS}$ constraint needs to be satisfied is `((not p'p) and`. At this point the comprehender knows that the sentence is rejected in worlds in C where $(\textit{not } p'p)$ is rejected, i.e. in worlds where either $p' = 1$ and $p = 1$, or in worlds where $p' = 0$. So, the constraint demands that:

(113) For all p: $\{w \mid (p' = 1 \textit{ and } p = 1) \textit{ or } p' = 0\} \subseteq \{w \mid p = 1\}$

[66] Although, as it can be easily verified, atomic sentences and their negation always have equivalent presuppositions in *System 2*.

We are assuming that this holds, so it must hold for $p = \perp$. In this case the condition is re-written as:

(114) For all p: $\{w \mid p' = 0\} \subseteq \emptyset$

This holds iff $C \models p'$. It is easy to show subsequently that if $C \models p'$, then *Transparency*$_{LS}$ holds.

In this way, we derive that negating the first conjunct doesn't lead to symmetric conjunctions. Similarly, we can show that symmetry is preserved in disjunctions where the first disjunct is negated.

Fact 3.5.6. *((not $p'p$) or q) satisfies Transparency$_{LS}$ in a context C iff $C \models \neg q \rightarrow p'$.*

At parsing point `((not p'p) or` we know that this is accepted for all continuations in worlds where the first disjunct is true. In worlds where the first disjunct is false or undefined, there is nothing we can say for all possible continuations: then there are worlds where the whole disjunction is rejected (i.e., in worlds where the second disjunct is undefined or false), but also worlds where the whole disjunction is accepted (i.e., in worlds where the second disjunct is true). So, the only non-trivial requirement imposed by *Transparency*$_{LS}$ is:

(115) For all p: $\{w \mid p' = 1 \textit{ and } p = 1\} \subseteq \{w \mid p = 1\}$

It's clear that this holds for all p. The parse moves on, and we reach `((not p'p) or q`. Now, we can state the following conditions:

(116) a. For all p: $\{w \mid (p' = 1 \textit{ and } p = 1) \textit{ or } q = 1\} \subseteq \{w \mid p = 1 \textit{ or } q = 1\}$

b. For all p: $\{w \mid (p' = 0 \textit{ or } p = 0) \textit{ and } q = 0\} \subseteq \{w \mid p = 0 \textit{ and } q = 0\}$

We know already from *System 1* that these are satisfied just in case $C \models \neg q \rightarrow p'$. Therefore, symmetry is preserved, even when the first disjunct is negated.

So far then, System 2 has delivered on the promise of keeping the asymmetry of conjunction and the symmetry of disjunction, but without introducing surprising (a-)symmetries when the first conjunct/disjunct is negated. However, keeping to a Strong Kleene logic leads to a breakdown in the case of conditionals.

3.5.5. Conditionals

Consider $(if\ p'p.\ q)$. The following fact holds:

Fact 3.5.7. *A conditional of the form* $(if\ p'p.\ q)$ *respects Transparency*$_{LS}$ *iff* $C \models \neg q \rightarrow p'$.

At parsing point `(if p'p.` the sentence is accepted in worlds where $p'p$ is false. In worlds where it's true or undefined, the Strong Kleene tables do not allow us to make a statement that holds regardless of continuation: it could be true, if the second argument is true, or undefined (if $p'p$ is undefined and the second argument is false or undefined) or even false (if $p'p$ is true and the second argument is false). So, the only requirement that comes out of the constraint is that:

(117) For all p, $\{w|\ p' = 1\ and\ p = 0\} \subseteq \{w|\ p = 0\}$

It is easy to see that this holds without imposing any conditions on C. Therefore, the parse moves on and we get access to `(if p'p. q`. This is accepted in worlds where the Strong Kleene table says it's true, and rejected where the table says it's false or undefined. Therefore, we *Transparency*$_{LS}$ requires:

(118) a. For all p, $\{w|\ (p' = 1\ and\ p = 0)\ or\ q = 1\} \subseteq \{w|\ p = 0\ or\ q = 0\}$

b. For all p, $\{w|\ (p' = 0\ or\ p = 1)\ and\ q = 0\} \subseteq \{w|\ p = 0\ and\ q = 0\}$

The first condition clearly holds. Going through the relevant calculations reveals that the second condition above holds just in case $C \models \neg q \rightarrow p'$. But recall that part of the empirical requirements we are taking conditionals to embody is that (at least in unnegated cases) the presuppositions in the antecedent do not allow symmetric filtering from the consequent. But this is what we just derived. Therefore, if we want to keep on to *System 2* something has to give in the case of the conditional.

3.5.6. Redefining the truth table

The space of options The reason we get into trouble with the conditional if we adopt the Strong Kleene truth table is that knowing that the antecedent is false or undefined tells us nothing about the truth value of the entire conditional. On System 1, knowing that the antecedent was false (either because p' was false of because p was false), meant that the entire conditional was true; this then allowed the checking of the $\mathit{Transparency}_{LS}$ constraint to happen in a nontrivial way, leading to the requirement that the relevant presuppositions be established in C.

If we are to replicate this effect then in System 2, we need a truth table for conditionals that incorporates trivalence, but at the same time allows us to know something about the truth value of the entire conditional in cases where the antecedent is undefined or false.

One thing to make clear at this point: the reason it will not suffice to have a truth table for the conditional that lets us know the truth value of the conditional only in the case where the antecedent is undefined has to do with conjunctions embedded in antecedents. Consider the following case (discussed more explicitly later):

(119) $(if\ (p'p\ and\ q).\ r)$

We want the presupposition of the first conjunct to project. At parsing point `(if (p'p and` we know that the entire conjunction is undefined or false when $p' = 0$ (this follows by the Strong Kleene table for conjunction). Therefore, for the $\mathit{Transparency}_{LS}$ constraint to apply nontrivially at this point, we have to know something about the truth value of the conditional when the antecedent is false or undefined (not *just* undefined), and this something needs to hold for all possible continuations. If knowing worlds where the embedded conjunction is false or undefined for all continuations tells us nothing about the truth value of the conditional for all possible continuations, then the *Transparency$_{LS}$* constraint is satisfied trivially, and the parse moves on. But this means that the comprehender will get access to the second conjunct, which then can be used to filter the presuppositions of the first conjunct.

A question on top of all this is the extent to which we would like this new truth table to be predictable on the basis of classical logic. After all, part of the appeal of the Strong Kleene tables is that they derive by essentially applying classical logic, with # appearing when classical logic fails to provide an unambiguous truth value.

Here, we briefly look at two options: Option 1 preserves a relation between the trivalent conditional and classical logic. Option 2 preserves the Strong Kleene tables for conjunction and disjunction, but replaces the table for the conditional with the so-called de Finetti conditional, (see Égré et al. 2021 for a recent presentation and discussion).

Option 1 One way to get a system that when applied to just 1 and 0 yields classical logic, but when applied to 1, 0 and # yields the Strong Kleene tables for conjunction, disjunction and negation, but a different table for the conditional goes as follows: take # to represent a kind of falsity, that is less strong than 0, but stronger than full truth. We can think of this formally by taking the models of our language to come with a set of worlds W, a set of truth values $T = \{1, 0, \#\}$, a partial ordering $\leq_t$ on T that ranks 1 on top, 0 on the bottom, and # between 0 and 1 (this reflects the idea that # is a kind of untruth that is not as severe as 0; see also Fitting 1991 for constructions of this sort, as well Winter 2019 for discussion in the context of trivalent logic for presupposition), and a function a function I from pairs of worlds and atomic literals of $\mathcal{L}$ of the p_i form, to truth values. I maps these pairs to $\{0, 1\}$ depending on whether p_i is true or false in w. I is extended to a function from pairs of worlds and $\mathcal{L}$-sentences, to $\{0, 1, \#\}$ via the following definition:

Definition 3.5.2. I Given a world w and an $\mathcal{L}$-sentence S:

- If $S := p'p$, then $I(w, S) = 1$ if $I(w, p') = 1$ and $I(w, p) = 1$. $I(w, S) = 0$ if $I(w, p') = 1$ and $I(w, p) = 0$. $I(w, S) = \#$ otherwise.

- If $S := (not\ A)$, then $I(w, S) = 1$ if $I(w, A) = 0$. $I(w, S) = 0$ if $I(w, A) = 1$. $I(w, S) = \#$ otherwise.

- If $S := (A\ and\ B)$, then $I(w, S) = I(w, A)$ if $I(w, A) \leq_t I(w, B)$. $I(w, S) = I(w, B)$ otherwise.

- If $S := (A\ or\ B)$, then $I(w, S) = I(w, A)$ if $I(w, B) \leq_t I(w, A)$. $I(w, S) = I(w, B)$ otherwise.

- If $S := (if\ A.\ B)$, then $I(w, S) = 1$ if $I(w, A) \neq 1$. $I(w, S) = I(w, B)$ otherwise.

If restricted to a system with only two truth values, 0 and 1, where $0 \leq_t 1$, then the rules above produce classical propositional logic. Applied to three truth values, they derive the following truth tables. In the case of conjunction, disjunction and negation, these are just the Strong Kleene tables. The conditional case is the different one:

$if\ (\alpha).\ (\beta)$	T	F	$\#$
T	T	F	$\#$
F	T	T	T
$\#$	T	T	T

Now the conditional is true when the antecedent is false or undefined. Let's call this the 'untrue to true' view (**UT view**). A consequence of this is that given $(not\ (if\ p'p.\ q))$, this is predicted to be false, in a world where $p' = 0$ and the antecedent suffers from presupposition failure. In this case, the antecedent is undefined, hence the conditional is true, while the negation of the conditional is false. We can try to test this via the following example, where a conditional with an undefined antecedent is negated:

(120) a. **Context:** We know that John has never played the cello.

b. ?It's not the case that if John continues to play the cello, then he will have an instrument for sale.

While (120b) certainly doesn't seem true, it's hard to judge if it's false or neither false nor true (undefined). At the same time, it does seem on par with a conditional whose antecedent is just plain false in the context:

(121) a. **Context:** We know that John has never played the cello.

b. ?It's not the case that if John played the cello in the past, then he will have an instrument for sale.

If that is indeed the case, then a truth table that makes cases of presupposition failure in the antecedent equivalent in truth to cases of falsity of the antecedent might have something explanatory to say about such cases. At the same time, just because both conditionals do not appear true in this case, this doesn't mean that both of them have the same non-true value; it could be that the case that (121b) is false, whereas (120b) simply #.

Option 2 The option we just outlined groups together cases where the antecedent is false or undefined by making the whole conditional be accepted/true in those cases. The other way to go here would be to group the cases where the antecedent is 0 or # by assigning to the whole conditional 'rejection' values in those cases, i.e. (0 or #). A conditional that instantiates this pattern is, for example, the so-called 'de Finetti' conditional, (de Finetti, 1936; Égré et al., 2021), and it looks as follows:

$if\ (\alpha).\ (\beta)$	T	F	#
T	T	F	#
F	#	#	#
#	#	#	#

Table 3.12: The 'de Finetti' conditional

This conditional has been explored in certain logics that aim to deal with the so-called paradoxes of material implication, (see Égré et al. 2021 for discussion). On the classic material implication view of the conditional, the conditional is true in the case where the antecedent is false. This creates a situation where, when the antecedent is false, the consequent doesn't matter, which seems to go against the intuition that conditionals express a relation between the antecedent and the consequent. On the de Finetti conditional in 3.12, the conditional is undefined when the antecedent is false. The intuition underlying this is that a conditional sentence expresses a 'conditional bet': uttering a conditional $if(A).\ (B)$ means that I'm betting that B is true when A is true. If that happens, I win the bet and the conditional is true. If B is false, I lose the bet and the conditional is false. But if A is not true, then the bet has no meaning/is 'void', which here is captured by the # value.

Note that by putting together the de Finetti conditional with a theory of presupposition we are saying that there are at least two causes of undefinedness: the first concerns presupposition failure, the second conditionals with false antecedents. Both causes of undefinedness are treated in the same way in complex sentences: conjunction, disjunction and negation follow the Strong Kleene tables, whereas the conditional follows the de Finetti table.[67] Moreover, by taking on the idea that non-truth of the antecedent translates into undefinedness in conditionals, we are moving away from a connection between classical logic, and the distribution of the # value. To the extent that the projection algorithm is not identified with the distribution of the # value (see also fn 65), this still keeps the projection part of the theory explanatory. However, it does mean that the choice of the underlying truth tables can no longer be taken to be 'natural', at least not without some other kind of independent justification. My aim isn't to provide such justification here (after all, it will turn out that the de Finetti table makes some unintuitive predictions when combined with $Transparency_{LS}$); but this is a question that must eventually be answered by approaches that deviate too far from classical logic.

Finally, there are variations on the de Finetti conditional that would still be adequate for our purposes later.[68] For instance, the so-called 'Farrell conditional', (Farrell 1979, again see Égré et al. 2021) is just like the de Finetti conditional, but the conditional is false when the antecedent is # and the consequent 0. Since from our point of view, whenever the antecedent receives a rejection value, the whole conditional receives a rejection value, and that is enough.

[67] Of course it could be that we are fundamentally dealing with two different kinds of undefinedness here, and these should not be represented with the same third truth value. But investigation of this possibility would take us too far afield.

[68] Note that the Middle Kleene table is not an option, since the cases where the antecedent is false or undefined are not grouped together for all possible continuations. This then creates an issue with the embedded conjunction cases discussed above.

$if\ (\alpha).\ (\beta)$	T	F	$\#$
T	T	F	$\#$
F	$\#$	$\#$	$\#$
$\#$	$\#$	F	$\#$

Table 3.13: The ‘Farrell’ conditional

However, what is not compatible with our aims is a table where the 0/# of the antecedent does not commit the conditional to a rejection or to an acceptance value. This is the case for instance with the ‘Cooper-Cantwell’ conditional, (Cooper 1968; Cantwell 2008, cf. Égré et al. 2021):

$if\ (\alpha).\ (\beta)$	T	F	$\#$
T	T	F	$\#$
F	$\#$	$\#$	$\#$
$\#$	T	F	$\#$

Table 3.14: The ‘Cooper-Cantwell’ conditional

The ‘Cooper-Cantwell’ conditional treats # in the antecedent the same as 1. But for our purposes this means that we know nothing about the overall truth value of the conditional when the antecedent shows presupposition failure, which is the situation we want to avoid. At any rate, here I will stick with the original de Finetti table, as this will be enough to make the general point.

3.5.7. Back to the conditional

Fact 3.5.8. *A conditional of the form* $(if\ p'p.\ q)$ *respects* $Transparency_{LS}$ *iff* $C \models p'$.

$Transparency_{LS}$ requires that for all p, the set of worlds where `(if p’p.` is accepted regardless of continuation be a subset of the set of worlds where `(if p.` accepted regardless of continuation. On the idea that worlds where the antecedent is false or undefined are worlds where the conditional is true, then the requirement becomes:

(122) For all p: $\{w \mid p' = 0\ or\ p = 0\} \subseteq \{w \mid p = 0\}$

We know from previous examples that this holds just in case $C \models p'$.

On the idea that worlds where the antecedent is false or undefined are worlds where the conditional is undefined, then the same requirement is essentially imposed, only now from the point of view of acceptance rather than rejection.

Fact 3.5.9. *A conditional of the form* $(if\ q.\ p'p)$ *respects Transparency*$_{LS}$ *iff* $C \models q \rightarrow p'$.

Transparency$_{LS}$ requires that for all p, the set of worlds where `(if q. p'p` is accepted/rejected regardless of continuation be a subset of the set of worlds where `(if q. p` accepted/rejected regardless of continuation. On the view that the conditional is accepted either when the antecedent is false/undefined or when the consequent is true, we have:

(123) For all p: $\{w \mid (p' = 1 \textit{ and } p = 1) \textit{ or } q = 0\} \subseteq \{w \mid p = 1 \textit{ or } q = 0\}$

On the same view, the conditional is rejected when the antecedent is true and the consequent is false/undefined:

(124) For all p: $\{w \mid (p' = 0 \textit{ or } p = 0) \textit{ and } q = 1\} \subseteq \{w \mid p = 0 \textit{ and } q = 1\}$

We know from the corresponding *System 1* example that this holds just in case $C \models q \rightarrow p'$.

On the de Finetti table, the conditional is accepted if the antecedent is true and the consequent is true. So, the constraint requires:

(125) For all p: $\{w \mid p' = 1 \textit{ and } p = 1 \textit{ and } q = 1\} \subseteq \{w \mid p = 1 \textit{ and } q = 1\}$

This clearly holds. The conditional is rejected otherwise. So, the constraint becomes:

(126) For all p: $\{w \mid p' = 0 \textit{ or } p = 0 \textit{ or } q = 0\} \subseteq \{w \mid p = 0 \textit{ or } q = 0\}$.

As above, this holds just in case $C \models q \to p'$.

Turning to conditionals with negated antecedents, we find asymmetric patterns, i.e:

Fact 3.5.10. *$(if\ (not\ p'p).\ q)$ satisfies Transparency$_{LS}$ in a context C iff $C \models p'$.*

At `(if (not p'p).` we know that the worlds where the antecedent is false or undefined are mapped to true. So the constraint requires that:

(127) For all p: $\{w \mid p' = 0 \textit{ or } p = 1\} \subseteq \{w \mid p = 1\}$

Going through the regular routine reveals that this holds just in case $C \models p'$.

On the de Finetti view, exactly the same requirement is imposed, since at this parsing point we know that all worlds where the antencedent is undefined ($p' = 0$) or false ($p' = 1,\ p = 1$), then the conditional is rejected.

Moving on to antecedent-final conditionals, the UT and de Finetti appraoches part ways. On the UT view, we have the following:

Fact 3.5.11. *A conditional of the form $(q.\ if\ p'p)$ respects Transparency$_{LS}$ iff $C \models \neg q \to p'$.*

The conditional is is accepted in worlds where q is true or $p'p$ is undefined or $p'p$ is false. So, the requirement imposed by *Transparency$_{LS}$* is:

(128) For all p: $\{w \mid p' = 0 \textit{ or } p = 0 \textit{ or } q = 1\} \subseteq \{w \mid p = 0 \textit{ or } q = 1\}$.

This holds just in case $C \models \neg q \to p'$. It is rejected when $p'p$ is true and q is false, which leads to a requirement that is always satisfied.

On the de Finetti table, the conditional is accepted just in case $p'p$ is true and q is true. It is rejected otherwise. The part of the constraint that refers to the acceptance case is always satisfied.

For the rejection case, we have:

(129) For all p: $\{w \mid p' = 0 \text{ } or \text{ } p = 0 \text{ } or \text{ } q = 0\} \subseteq \{w \mid p = 0 \text{ } or \text{ } q = 0\}$.

Going through the usual reasoning reveals that this holds just in case $C \models q \rightarrow p'$.[69]

Finally, let's discuss the case of conjunctions and disjunctions embedded in antecedents.

Fact 3.5.12. *(if ($p'p$ and q). r) presupposes p'.*

On the UT view, at parsing point `(if (p'p and` we know that the conditional is true in worlds where $p' = 0$ or $p = 0$. Therefore, the constraint demands:

(130) For all p: $\{w \mid p' = 0 \text{ } or \text{ } p = 0\} \subseteq \{w \mid p = 0\}$

We know that this holds just in case $C \models p'$. On the de Finetti view, the conditional is undefined in worlds where the conjunction is undefined or false, so the condition imposed is exactly the same.

Fact 3.5.13. *(if ($p'p$ or q). r) presupposes $C \models \neg q \rightarrow p'$.*

Again, we start with the UT view. At parsing point `(if (p'p or` we know that the antecedent is already true in all worlds where $p'p = 1$. This tells us nothing about the overall truth value of the conditional in these worlds.

Thus, the parse moves on. At parsing point `(if (p'p or q`, we know that the antecedent is undefined in worlds where $p' = 0$ and $q = 0$, while it's false in worlds where $p' = 1$ and $p = 0$ and $q = 0$. In these cases the entire conditional is true, so the constraint requires:

(131) For all p :$\{w \mid (p' = 0 \text{ } or \text{ } p = 0) \text{ } and \text{ } q = 0\} \subseteq \{w \mid p = 0 \text{ } and \text{ } q = 0\}$

[69] Note that this result doesn't change if we change the conditional table to the Farrell table discussed earlier.

Reasoning in the following way, this holds just in case $C \models \neg q \to p'$. Conversely, one can check that when $C \models \neg q \to p'$, the relevant requirements hold at all parsing points.

On the de Finetti view, in worlds where the antecedent is false or undefined, the entire conditional is undefined. In fact, this leads to the same condition as above which is again satisfied just in case $C \models \neg q \to p'$.

The next two subsections take a look at cases of multiple triggers, and conjunctions embedded in disjunctions. These cases involve no conditionals and hence are independent of the choice between UT and de Finetti.

3.5.8. Multiple triggers

We start with the following:

Fact 3.5.14. *($p'p$ and $q'q$) presupposes $C \models p'$.*

At parsing point `(p'p and` we know that the sentence is rejected in worlds where $p' = 0$ or $p = 0$. Hence, the following requirement is imposed:

(132) For all p: $\{w|\ p' = 0\ \textit{or}\ p = 0\} \subseteq \{w|\ p = 0\}$

We have seen enough times now that this is is satisfied just in case $C \models p'$.

Since negating the first conjunct doesn't change the asymmetry of conjunction, the following also holds:

Fact 3.5.15. *((not $p'p$) and $q'q$) presupposes $C \models p'$.*

Moving on to cases of disjunction, we have:

Fact 3.5.16. *($p'p$ or $q'q$) presupposes $C \models ((p'$ or $q'q)$ and $(q'$ or $p'p))$.*

Exactly the same reasoning as in *System 1* and Transparency derives this.

Fact 3.5.17. *$((not\ p'p)\ or\ q'q)$ presupposes $C \models (p' \vee (q' \wedge q)) \wedge (q' \vee (p' \wedge \neg p))$.*

At parsing point `((not p'p) or` the sentence is accepted in worlds where $p' = 1$ and $p = 0$. So the constraint demands that:

(133) For all p: $\{w|\ p' = 1\ and\ p = 0\} \subseteq \{w|\ p = 0\}$

This is clearly true. The parse moves on. At `((not p'p) or q` we know that the sentence is accepted in worlds where $p' = 1$ and $p = 0$, or $q'q = 1$. It is rejected in worlds where $p' = 0$ or $p = 1$, and $q' = 0$ or $q = 0$. Thus, the constraint demands that:

(134) a. For all p: $\{w|\ (p' = 1\ and\ p = 0)\ or\ (q' = 1\ and\ q = 1)\} \subseteq \{w|\ p = 0\ or\ (q' = 1\ and\ q = 1)\}$

b. For all q: $\{w|\ (p' = 1\ and\ p = 0)\ or\ (q' = 1\ and\ q = 1)\} \subseteq \{w|\ (p' = 1\ and\ p = 0)\ or\ q = 1\}$

(135) a. For all p: $\{w|\ (p' = 0\ or\ p = 1)\ and\ (q' = 0\ or\ q = 0)\} \subseteq \{w|\ p = 1\ and\ (q' = 0\ or\ q = 0)\}$

b. For all q: $\{w|\ (p' = 0\ or\ p = 1)\ and\ (q' = 0\ or\ q = 0)\} \subseteq \{w|\ (p' = 0\ or\ p = 1)\ and\ q = 0\}$

Clearly, the conditions in (134) are satisfied. The condition in (135a) is satisfied just in case $C \models p' \vee (q' \wedge q)$. The condition in (135b) is satisfied just in case $C \models q' \vee (p' \wedge \neg p)$. Note that in the case where $p' = q'$, this is equivalent to $C \models p'$.

3.5.9. Linearity

Finally, we consider the cases conjunctions embedded in disjunctions, which due to the linearity of the constraint are predicted to show symmetric effects, just like in *System 1*.

Fact 3.5.18. *$((p'p$ and $q)$ or $r)$ presupposes that $C \models q \rightarrow (p' \vee r)$.*

At parsing point `((p'p and q) or` the constraint demands that

(136) For all p: $\{w|\ p' = 1 \textit{ and } p = 1 \textit{ and } q = 1\} \subseteq \{w|\ p = 1 \textit{ and } q = 1\}$

This clearly holds. the parse moves on. At `((p'p and q) or q` we have:

(137) For all p: $\{w|\ (p' = 0 \textit{ or } p = 0 \textit{ or } q = 0) \textit{ and } r = 0\} \subseteq \{w|\ (p = 0 \textit{ or } q = 0) \textit{ and } r = 0\}$

This is just like Fact 3.4.15 in *System 1*.

3.5.10. Empirical outlook

Basics *System 2* manages to preserve the core 'asymmetric conjunction, but symmetric disjunction' prediction of *System 1*. However, negating a presuppositional conjunct or disjunct now has no effect on the (a-)symmetric filtering profile of these connectives. This also means that conjunctions with negated first conjuncts no longer give rise to symmetric filtering in the case of multiple presupposition triggers (which was an issue on *System 1*)

Another twist added by *System 2* concerned the case of (*not* $(p'p$ *and* $q)$), which allows for symmetric filtering if $C \models q \rightarrow p'$ (see Fact 3.5.4). Empirically, this means that sentences like (138b) below should not carry a presupposition:

(138) a. **Context:** We know that John doesn't smoke Marlboros, however we have no idea if he smokes.

b. It's not the case that John stopped smoking and used to smoke Marlboros.

Again, careful experimentation is required to fully settle issues of this kind.

Conditionals With respect to conditionals we explored two different options: the UT option rooted more directly in classical logic, while the de Finetti option was developed as a response to the paradoxes of material implication. They diverged with respect to the case of antecedent-final conditionals. On the de Finetti approach, $(q.\ if\ p'p)$ was predicted to satisfy *Transparency*$_{LS}$ as long as $C \models q \rightarrow p'$. On the UT approach we derived the usual conditional presupposition we also derive in *System 1*. The prediction concerns case like the following:

(139) a. **Context:** We find a full pack of Marlboros in John's garbage. We have no idea if he ever used to smoke. So, we think:

b. (#) John used to smoke Marlboros, if he stopped smoking.

On the UT approach, this should carry a presupposition that John used to smoke, while on the de Finetti approach, there should be no presupposition (the consequent entails the presupposition of the antecedent). My own intuition is that (139b) presupposes that John used to smoke. At any rate, the de Finetti table also gets us in trouble with respect to the following kind of conditional:

(140) a. **Context:** We find a full pack of Marlboros in John's garbage. We have no idea if he ever used to smoke. So, we think:

b. ✓John stopped smoking, if he used to ($\rightsquigarrow$ $(p'p.\ if\ q)$

On the de Finetti table, at parsing point `(p'p. if` we know that the conditional is false or undefined in all worlds where the consequent is false or undefined. Therefore, the constraint demands that:

(141) For all p: $\{w|\ p' = 0\ \textit{or}\ p = 0\} \subseteq \{w|\ p = 0\}$

We know that this boils down to the requirement that $C \models p'$. This means that (140b) should carry the presupposition that John used to smoke. However, as it has been discussed in the literature on projection, (Heim, 1990; Soames, 1979; Chierchia, 2009; Mandelkern & Romoli, 2017), conditionals like (140b) show filtering, just like their antecedent-initial counterparts. Therefore, the de Finetti table puts us in a corner. The UT approach on the other hand predicts the standard filtering pattern here, since just knowing that the consequent is false or undefined doesn't tell us anything about the overall truth value of the conditional (the rest is like Fact 3.5.9). The data then is on the side of UT.

Linearity It continues to be the case on *System 2* that 'linearity effects' continue to hold. Thus, the discussion in section 4.9 on this topic applies here as well.

Table 3.15 summarizes the predictions of *System 2* (on the UT approach, and excluding the cases of multiple triggers).

Sentence	System 1	System 2
$(p'p\ and\ q)$	$C \models p'$	$C \models p'$
$((\neg p'p)\ and\ q)$	$C \models q \rightarrow p'$	$C \models p'$
$(p'p\ or\ q)$	$C \models \neg q \rightarrow p'$	$C \models \neg q \rightarrow p'$
$((\neg p'p)\ or\ q)$	$C \models p'$	$C \models \neg q \rightarrow p'$
$(if\ p'p.\ q)$	$C \models p'$	$C \models p'$
$(q.\ if\ p'p)$	$C \models \neg q \rightarrow p'$	$C \models \neg q \rightarrow p'$
$(if\ (not\ p'p).\ q)$	$C \models \neg q \rightarrow p'$	$C \models p'$
$\neg(p'p\ and\ q)$	$C \models p'$	$C \models q \rightarrow p'$
$((p'p\ and\ q)\ or\ r)$	$C \models q \rightarrow (p' \vee r)$	$C \models q \rightarrow (p' \vee r)$

Table 3.15: Summary core predictions for System 1 vs System 2

We now turn to the final system that we develop in this chapter.

3.6. A structural alternative

Preliminaries The final system that we will investigate attempts to import a predictive theory of symmetry into a version of dynamic semantics. We start by outlining the intuitions behind the idea. Then we give a brief intro to the way Rothschild 2011 reconstructs dynamic semantics, and finally explain how the idea can work in that framework.

Dynamic semantics, Heim 1983b, is based on the idea that sentences denote instructions to update the context; these instructions are known as Context Change Potentials (CCPs). In that sense, the denotation of sentences can be modeled as a function from contexts (sets of worlds) to contexts. For example, 'John left' can be associated with a function f that takes a world w and returns true just in case John left in w. The meaning of 'John left' then on this approach is as follows:

(142) $G = \lambda C.\ C \cap \{w|\ f(w) = 1\}$

G takes a context C and returns the intersection of C with the worlds where John left. A widely used piece of notation for incrementing C with 'John left' is as $C[John\ left]$. Using this we can write:

(143) $C[John\ left] = G(C)$

This should be understood as follows: the result of incrementing C with 'John left' is equivalent to applying the function in (142) to C, returning the set of worlds in C where John left.

The way this extends to presuppositions is by taking sentences carrying a presupposition to be associated with partial functions. For example 'John stopped smoking' is associated with a partial function that is defined only on worlds where John used to smoke, and returns true just in case it applies to a world where John currently doesn't smoke. Crucially, given a presuppositional sentence

α associated with a partial function f', the incrementation of C with α, $C[\alpha]$, is defined just in case all the worlds in C are in the domain of f'.

The whole game in dynamic semantics is to state how complex sentences likes $(\alpha * \beta)$ should update the context. This is done by stating rules that re-write an expression like $C(\alpha * \beta)$ in terms of it's sub-parts.[70] For example we can write the following:

(144) $C[\alpha \wedge \beta] = (C[\alpha])[\beta]$

This means that the result of incrementing C with $\alpha \wedge \beta$ is equivalent to incrementing with β the result of the incrementing C with α.

Complex incrementations like $C[\alpha \wedge \beta]$ in (144) are defined just in case all the sub-expressions of the form $a[\gamma]$ on the right hand side of (144) are defined. This means that $C[\alpha]$ must be defined, and $(C[\alpha])[\beta]$ must be defined. This means that all the worlds in C are in the domain of the function associated with α, and all the worlds in C where α is true are in the domain of the function associated with β. So C must satisfy the presuppositions of α and the result of incrementing C with α must satisfy the presuppositions of β. These are asymmetric filtering conditions for a conjunction $(\alpha \wedge \beta)$.

Note that in dynamic semantics definedness conditions are calculated on the basis of how the

[70] I implicitly follow Rothschild 2011 here in taking a re-write rule for an expression $C[\phi * \psi]$ to have the following definition:

(i)
a. C is a re-write rule for $C[\phi * \psi]$
b. If a is a rewrite rule for $C[\phi * \psi]$, so are $a[\phi]$ and $a[\psi]$
c. If a and b are rewrite rules for $C[\phi * \psi]$, so are $a \cap b$, $a \cup b$, $a - b$

Note also that re-write rules need to be truth-conditionally adequate in the following sense:

(ii) A re-write rule γ for $\alpha[\phi * \psi]$ is truth conditionally adequate iff for arbitrary sentences p, q, and a, $a \wedge (p * q)$ is logically equivalent to to γ', where γ' results from making the following syntactic changes to γ:
a. any sub-expression of the form $\beta[\tau]$ is replaced by $\beta \wedge \tau$
b. α is replaced with a, ϕ with p, ψ with q, $\cup$ with $\vee$, $\cap$ with $\wedge$, and $-$ with $\wedge\neg$

Finally, Rothschild 2011 takes $\alpha[\phi * \psi]$ to be defined iff a) there exists a truth-conditionally adequate re-write rule for $\alpha[\phi * \psi]$ whose semantic value is defined and b) all such re-write rules have the same semantic value. When defined, the semantic value of $\alpha[\phi * \psi]$ is that of the truth-conditionally adequate rules for it.

sub-constituents that make up a sentence S are integrated into the context, rather than on the basis of some calculation that takes the string that makes up S as input. It is in this sense that the system is structural rather than linear.

The idea The core of our idea is as follows. When incrementing the context with a sentence S, comprehenders follow one of two strategies: **i)** find the worlds in C where S is true and keep those. **ii)** find the worlds in C where S is false, and remove them from C.

Usually, many different ways of updating C with S will be compatible with these two strategies. But suppose that given a sentence $S = (\alpha * \beta)$, we know that the subset C_α of C where α is true contains all of the worlds where S is true, or all of the worlds where S is false. Then a clear strategy would be to find these C_α worlds, and either find the true worlds, and keep them, or find the false worlds and remove them. We will assume that in those cases, comprehenders employ exactly this strategy. This can be made more precise as follows:

(145) In the case where all worlds in C where $S = (\alpha * \beta)$ is true are in C_α, the update will take the form $(C[\alpha])[\gamma]$, where $\gamma \in \{\beta, \neg\beta\}$ depending on which of the two leads to a rule that captures the truth of S (see also fn 70 for a notion of truth-conditional adequacy of a re-write rule).

(146) In the case where all worlds in C where $S = (\alpha * \beta)$ is false are in C_α, the update will take the form $C - (C[\alpha])[\gamma]$, where $\gamma \in \{\beta, \neg\beta\}$ depending on which of the two makes $(C[\alpha])[\gamma]$ capture the truth of $\neg S$.[71]

[71] The template starts by computing the subset of the context C where the first argument of some truth functor $*$ is true. We can imagine two ways in which to specify what it means to be a first argument. One way takes the argument to be **linearly** first. The other way is to take the first argument to be the argument that **composes** first with the truth functor. To maintain asymmetry on the second option, one has to assume that arguments that appear linearly to the left of a truth functor, compose first with it. For example, in $(\alpha \wedge \beta)$, one has to assume that α is the first argument that the function $\lambda x_t.\lambda y_y.\ x = y = 1$ takes. This would seem to go against the idea that the syntactic complement of 'and' in natural language is the right argument, ($[\alpha\ [\wedge\ \beta]]$). One way out of this, proposed in Chierchia 2009, is to take conjunctions to really have the structure [[Both α] [$\wedge$ β]], where 'both' denotes the conjunction truth functor, and $\wedge$ is a semantically null element. 'Both' is unpronounced, but $\wedge$ is pronounced, leading to the surface form we encounter. A similar change has to implemented with respect to disjunction, by taking all disjunctions to have a silent 'either' that is analogous to 'both'. This is obviously a large departure from the syntax of conjunction as it is classically conceived.

For example, if $S = (\alpha \wedge \beta)$, then the worlds in C where S is true are contained in the worlds where α is true. Thus, the rule for $C[\alpha \wedge \beta]$ is $(C[\alpha])[\beta]$.

For a conditional $S = (\alpha \to \beta)$, all the worlds where S is false are worlds where α is true: specifically they are the worlds where α is true and β is false. Therefore, $C[(\alpha \to \beta)] = C - (C[\alpha])[\neg\beta])$.

Essentially, a template is imposed on what counts as a preferred re-write rule for an expression $C[\phi * \psi]$.[72] The effect of this is that conjunction and conditionals have asymmetric definedness conditions. The definedness conditions for the conjunction entry were explained above; for the conditional entry, $C - (C[\alpha])[\neg\beta])$ is defined just in case $C[\alpha]$ is defined and $(C[\alpha])[\beta])$ is defined. Therefore, the presuppositions of α must be satisfied in C and the presuppositions of β must be satisfied in the worlds in C where α is true.

On the other hand, with a disjunction $S = (\alpha \vee \beta)$ it's not the case that all of the worlds where S is true are worlds where α is true; neither is it the case that all the worlds where S is false are worlds where α is true. Thus, in this case, any truth-conditionally adequate re-write of $C[\alpha \vee \beta]$ is available to comprehenders. Rothschild 2011 shows that under certain assumptions, this mean that $C[\alpha \vee \beta]$ is defined just in case $C[\neg\alpha][\beta]$ is defined or $C[\neg\beta][\alpha]$ is defined.[73] The effect of this

[72] For a different approach to using templates to restrict dynamic semantics, and which is not concerned with predicting which connectives should show symmetry vs asymmetry, see LaCasse 2008.

[73] The conditions are: 1) that $C[\phi * \psi]$ is defined when at least one truth-conditionally adequate re-write rule is defined, and when defined $C[\phi * \psi]$ has the semantic value of the truth-conditionally adequate re-write rules for it. 2) expressions needs to have monotonic definedness conditions and intersective meaning:

(i) An expression ϕ has monotonic definedness conditions if for any C, if $C[\phi]$ is defined (in the sense of fn 70), then for any $C' \subseteq C$, $C'[\phi]$ is defined.

(ii) An expression ϕ has intersective meaning if for any C, if there is a set of worlds p such that for any C, when $C[\phi]$ is defined, it denotes $C \cap p$.

Given these, Rothschild 2011 shows the following proposition:

(iii) **Proposition:** Suppose ϕ and ψ are expressions with monotonic definedness conditions and intersective meanings, and C is a context. It follows that:

a. $C[\neg\phi]$ is defined iff $C[\phi]$ is defined
b. $C[\phi \wedge \psi]$ is defined iff $(C[\phi])[\psi])$ is defined or $(C[\psi])[\phi])$ is defined
c. $C[\phi \vee \psi]$ is defined iff $(C[\neg\phi])[\psi])$ is defined or $(C[\neg\psi])[\phi])$ is defined

is symmetric filtering conditions: a presupposition of α must either be entailed by all the worlds in C or all the worlds in C where β is defined and false; a presupposition in β must be entailed either by all the worlds in C, or by the worlds in C where α is defined and false.

This way of thinking then provides a truth-conditional criterion for deciding when a connective must update the context by following a certain template (and receiving asymmetric filtering conditions in the process) vs when it can update the context in any way that is truth-conditionally adequate. The criterion groups together conjunction and conditionals, to the exclusion of disjunction.

The criterion is based on truth conditions, and is quite general and predictive: given any connective with specified semantics, it will be decided whether it needs to follow a template or not. For example, if we take $unless(\alpha)(\beta)$ to have the truth conditions of $(\neg\alpha \to \beta)$ (cf. Chemla & Schlenker 2012), then *unless* can update the context in any way that is truth-conditionally adequate. The reason is that in worlds where α is true, there are worlds where $unless(\alpha)(\beta)$ is true and worlds where it's false. This follows from the fact that the semantics of $(\neg\alpha \to \beta)$ are equivalent to $(\alpha \vee \beta)$.

3.6.1. Conjunction

As we have seen the update for a conjunction is constrained to be:

(147) $C[\alpha \wedge \beta] = (C[\alpha])[\beta]$

This has fully asymmetric definedness conditions. As such the presupposition of the first conjunct will always be required to be entailed by C. This holds whether or not the first conjunct is negated or unnegated.

3.6.2. Disjunction

Disjunction is given symmetric definedness conditions. This holds regardless of whether a disjunct is negated.

d. $C[\phi \to \psi]$ is defined iff $(C[\phi])[\psi])$ is defined or $(C[\neg\psi])[\phi])$ is defined

Moreover, there are no 'linearity effects', since the current dynamic system does not proceed linearly on a string; rather the definedness conditions are stated recursively with respect to the arguments that a given connective takes. Therefore, given a conjunction embedded inside the first disjunct like $S = ((\alpha \wedge \beta) \vee \gamma)$, S is defined in a context C iff either of the following holds:

(148) a. $C[\alpha \wedge \beta]$ is defined and

b. $(C[\neg(\alpha \wedge \beta)])[\gamma]$ is defined

(149) a. $C[\gamma]$ is defined and

b. $(C[\neg\gamma])[(\alpha \wedge \beta)]$ is defined

So, in a case like $((p'p \wedge q) \vee r)$, filtering will occur just in case $\neg r \models p'$. It will not occur if $q \models (p' \vee r)$, contrary to *Systems 1, 2.* Thus we have:

Fact 3.6.1. $((p'p \wedge q) \vee r)$ *presupposes* $C \models \neg r \rightarrow p'$.

3.6.3. Negation

On the approach of Rothschild 2011 (which we are implicitly following here), any truth-conditionally adequate update for $C[\neg\phi]$ is defined iff $C[\phi]$ is defined (see fn 70 and fn 73).[74] Therefore, a negated expression $\neg\phi$ will always have the same definedness conditions as ϕ: any (a-)symmetries then that $\neg\phi$ might show depend entirely on any (a-)symmetries that ϕ shows. In this sense, the system is similar to *System 1* of *Limited Symmetry.*

This same feature, puts it at odds with one of the predictions made in *System 2*: $\neg(\alpha \wedge \beta)$ has exactly the same definedness conditions as $(\alpha \wedge \beta)$, and hence the same presuppositions. We saw in section 3.5.4 that $\neg(p'p$ *and* $q)$ is symmetric on *System 2*: no presupposition is predicted if $q \models p'$. However, if we were to interpret $\neg(p'p$ *and* $q)$ in the current dynamic system, with $p'p$ being defined in C just in case $C \models p'$, then the prediction is that $C[\neg(p'p$ *and* $q)]$ is defined iff $C[p'p]$ is defined,

[74] Note that the way we have stated our template on dynamic entries, it applies only on binary connectives. But, since we get adequate results for negation on Rothschild 2011's system without having to impose any special constraints on dynamic entries, it's not a problem that our statement of the template is limited in this way.

which happens iff $C \models p'$.

3.6.4. Conditionals

Conditionals have been given asymmetric definedness conditions. Crucially, nothing changes when the antecedent is negated:

(150) $C[(\neg\alpha \to \beta)] = C - (C[\neg\alpha])[\beta]$

This is defined just in case $C[\alpha]$ is defined and $(C[\neg\alpha])[\beta])$ is defined. Hence the context needs to entail any presuppositions of α.

The case of antecedent-final conditionals presents us with an interesting choice. On the one hand, we could take these conditionals to underlyingly have the structure $(\alpha \to \beta)$ (in line with the ideas in Romoli & Mandelkern 2018), and hence be handled by the normal re-write rule for the conditional. This would result in the presuppositions of the antecedent always projecting.

On the other hand, we could introduce a new connective with a $(\phi.\ if\ \psi)$ syntax. This is taken to be classically true and false in the same cases as $(\psi \to \phi)$. However, when we apply our template to determine how $C[(\phi.\ if\ \psi)]$ should be re-written, we have a choice: assuming **i)** that in conditionals, the antecedent composes first with the truth functor denoted by the connective, and **ii)** that our constraint finds the worlds where the argument that composes first is true, and checks whether these worlds include all the worlds where the whole sentence is eventually true/false, then the result is the same as with a normal conditional. The worlds where the antecedent is true include all the worlds where an antecedent-final conditional can be false.

Alternatively, we can ask whether the worlds where the linearly first argument (namely α) is true, include all the worlds where the whole sentence is true or false. Since α is essentially the consequent, this isn't the case. In this case then, the template predicts that any truth-conditionally adequate re-write rule for $C[(\phi.\ if\ \psi)]$ should be available. Given that the semantics here are the same as $(\phi \to \psi)$, then these re-write rules are the same as those for $(\phi \to \psi)$ (but without any template-related restrictions applying). We know from Rothschild 2011 that without imposing further restrictions (apart from those already stated in fn 73) $C[\phi \to \psi]$ is defined iff $(C[\phi])[\psi])$ is defined or $(C[\neg\psi])[\phi])$ is defined. This predicts that the negation of the consequent could filter the presuppositions of the antecedent.

3.6.5. Multiple triggers

In the case of a conjunction, it doesn't matter whether the second conjunct entails the presuppositions of the first conjunct, as the presuppositions of the first conjunct must be entailed by the context, per the update rule we have proposed. This means that the following holds:

Fact 3.6.2. $(p'p \wedge q'q)$ *presupposes that* $C \models p'$ *and that* $C \wedge p'p \models q'$.

Disjunctions on the other hand show behavior that is similar to Strong Kleene and symmetric Transparency. In the case of $(p'p \vee q'q)$ we have the following:

Fact 3.6.3. $(p'p \vee q'q)$ *presupposes* $C \models (p' \vee q'q) \wedge (q' \vee p'p)$.

$C[\alpha \vee \beta]$ is defined if either of the following hold:

(151) a. $C[\alpha]$ is defined and $(C[\neg\alpha])[\beta]$ is defined.

b. $C[\beta]$ is defined and $(C[\neg\beta])[\alpha]$ is defined.

Applying this to a case like $(p'p \vee q'q)$, we derive the following conditions:

(152) a. $C \models p'$ and $C \wedge \neg p'p \models q'$

b. $C \models q'$ and $C \wedge \neg q'q \models p'$

These in turn can be re-written as:[75]

[75] $C \wedge \neg q'q \models p'$ is equivalent to $C \models q'q \to p'$, which is equivalent to $C \models p'p \vee q'$. Similarly for the other condition.

(153) a. $C \models p'$ and $C \models p'p \vee q'$

b. $C \models q'$ and $C \models q'q \vee p'$

The disjunction of these two conditions is equivalent to:

(154) $C \models (p' \vee q'q) \wedge (q' \vee p'p)$

These are exactly the conditions that symmetric Transparency, Strong Kleene and both systems of *Limited Symmetry* derive.

However, contrary to symmetric Transparency, negating the two disjuncts in ($p'p$ *or* $q'q$) does not lead to a situation where there is mutual filtering in the case where $p' = q'$. The reason is that ($\neg p'p$ *or* $\neg q'q$) comes with the following definedness conditions:

(155) a. $C \models p'$ and $C \models p'p \rightarrow q'$

b. $C \models q'$ and $C \models q'q \rightarrow p'$

When $q' = p'$, the above conditions are equivalent to $C \models p'$. Therefore, the following holds:

Fact 3.6.4. $(\neg p'p \vee \neg q'q)$ *presupposes* $C \models p'$*, when* $p' = q'$*.*

3.6.6. Summary of predictions

Given our current knowledge of the empirical landscape, the dynamic system appears formidable: it gives asymmetric conjunction, but symmetric disjunction, and it even allows for some flexibility with antecedent final conditionals, depending on whether we take the order-of-arguments referred to by the template to be structural or linear. At the same time it avoids the potentially problematic cases of symmetric negated conjunctions, and asymmetric negated disjunctions fond in *System 1*. In contrast to *Systems 1, 2*, the dynamic system predicts the absence of what we have called 'linearity effects'. Finally, note that like *System 2*, the current dynamic system commits us to a prediction of asymmetry across all antecedent-initial conditionals, regardless of the presence of negation in the antecedent. Finally, the system's predictions in the case of multiple triggers parallel those of classic dynamic accounts (which in turn parallel Strong Kleene).

A summary of the predictions related to the core examples we have been studying (excluding the case of multiple triggers) is provided in table 3.16.

Sentence	System 1	System 2	Dynamic system
$(p'p\ and\ q)$	$C \models p'$	$C \models p'$	$C \models p'$
$((\neg p'p)\ and\ q)$	$C \models q \rightarrow p'$	$C \models p'$	$C \models p'$
$(p'p\ or\ q)$	$C \models \neg q \rightarrow p'$	$C \models \neg q \rightarrow p'$	$C \models \neg q \rightarrow p'$
$((\neg p'p)\ or\ q)$	$C \models p'$	$C \models \neg q \rightarrow p'$	$C \models \neg q \rightarrow p'$
$(if\ p'p.\ q)$	$C \models p'$	$C \models p'$	$C \models p'$
$(q.\ if\ p'p)$	$C \models \neg q \rightarrow p'$	$C \models \neg q \rightarrow p'$	$C \models p'$ OR $C \models \neg q \rightarrow p'$
$(if\ (not\ p'p).\ q)$	$C \models \neg q \rightarrow p'$	$C \models p'$	$C \models p'$
$\neg(p'p\ and\ q)$	$C \models p'$	$C \models q \rightarrow p'$	$C \models p'$
$((p'p\ and\ q)\ or\ r)$	$C \models q \rightarrow (p' \vee r)$	$C \models q \rightarrow (p' \vee r)$	$C \models \neg r \rightarrow p'$

Table 3.16: Summary core predictions for System 1 vs System 2 vs Dynamic system

3.7. A comparison with George 2008

3.7.1. Basics

In this last section, I would like to give a brief comparison between the systems developed in this chapter, and the so-called 'disappointment' algorithm of George 2008a. This is the only other attempt that I'm aware of to derive the asymmetry of conjunction and symmetry of disjunction in a predictive manner.

'Disappointment' is based on the idea that trivalent logic should be used to model presupposition projection, just like the logics we reviewed in section 2. It offers an algorithm for constructing trivalent truth tables out of bivalent truth tables. To explain the algorithm, it will be useful to think of a binary connective $*$ as denoting a truth functor f_*^b that takes a pair of truth values and maps it to a truth value:

(156) $f_*^b : \{T, F\} \times \{T, F\} \to \{T, F\}$

These are the classical bivalent connectives. We now want to extend these to trivalent function f_*^t:

(157) $f_*^t : \{T, F, \#\} \times \{T, F, \#\} \to \{T, F, \#\}$

The algorithm can be stated as follows:

(158) Given a binary connective denoting f_*^b, the trivalent connective denotes f_*^t, which is determined as follows:

a. Choose a $v \in \{T, F, \#\}$

b. If for all $v' \in \{T, F\}$, $f_*^b(v)(v')$ equals a constant value v'', then for all $v' \in \{T, F, \#\}$, $f_*^t(v)(v') = v''$.

c. Else, if there is no $v' \in \{T, F, \#\}$ such that $f_*^t(v)(v') = T$ on the Strong Kleene algorithm, then $f_*^t(v)(v') = \#$.

d. Otherwise: for any $v' \in \{T, F, \#\}$, the value of $f_*^t(v)(v')$ is determined on the basis of Strong Kleene.

This algorithm essentially has a connective look at its linearly first argument. If that argument has a truth value that on a classical bivalent understanding of the connective fixes the truth value of the sentence no matter the second argument, then that is the overall truth value. But if the overall value is not fixed (on the bivalent understanding of the connective), then you check if there exists a second argument that could make the whole sentence true on the Strong Kleene algorithm. If there is, then you look at the actual second argument, and apply the Strong Kleene algorithm to determine the final truth value. If there is no second argument that could make the sentence T on the Strong Kleene algorithm, then the sentence suffers from 'disappointment', in the sense that it has no chance to return the T value. Then the algorithm gives up and returns the # value.

So, in a conjunction, if the first conjunct is #, then no matter what the value of the second conjunct is, the Strong Kleene algorithm will never return true. So, the conjunction is undefined in those cases. The rest of the table is essentially determined by applying Strong Kleene. This derives the Middle Kleene table for conjunction.

In a disjunction on the other hand, when the first disjunct is # there is a possibility that the second disjunct will be true, which will lead to the whole disjunction being true on the Strong Kleene algorithm. So you look at the second argument and apply Strong Kleene. This leads to the Strong Kleene table for disjunction.

Applied to conditionals, this algorithm leads to the Strong Kleene implication, as even when the first argument is # a Strong Kleene conditional can be true in case the second argument is true.[76] As far as negation is concerned, it is assumed to follow Strong Kleene.

3.7.2. Conjunction

Because conjunction now follows the Middle Kleene table, asymmetry is predicted. This holds regardless of whether the first conjunct is negated. This part is very similar to the dynamic semantics system above.

3.7.3. Disjunction

Because disjunction now follows the Strong Kleene table, no asymmetry is predicted. This holds regardless of whether the first disjunct is negated. This part is again very similar to the dynamic semantics system above.

Again, due to the structural nature of the system, there are no linearity effects. For a conjunc-

[76] George 2008a says explicitly that he is not concerned with conditionals. Strong Kleene implication is essentially a generalization of material implication to three values, and there is enough evidence that conditionals in natural language are not to be identified with material implication (at least not always). However, given that other theories of projection take the material implication as a baseline in developing the theory, I think it's fair to at least contrast the predictions across theories using this same baseline.

tion embedded in the first disjunct like in the case of $((p'p \wedge q) \vee r)$, the p' presupposition is filtered just in case $C \models \neg r \rightarrow p'$. Entailment of p' by q doesn't help.

3.7.4. Negation

The behavior of negation in the 'disappointment' system of George 2008a is essentially equivalent to the behavior of negation in a dynamic semantics system. Negation leaves the definedness of an expression unaffected.

Moreover, there are again no 'linearity effects', and contrary to *System 2* negating a conjunction does not allow the second conjunct to filter a presupposition in the first conjunct. Thus, $\neg(p'p \wedge q)$ presupposes $C \models p'$ regardless of whether q entails p'.

3.7.5. Conditionals

As extended here to conditionals, 'disappointment' predicts symmetry: a presupposition in the antecedent is filtered if it is entailed by the negation of the consequent. This holds regardless of whether the antecedent itself is negated or not, and regardless of whether the conditional is antecedent-initial or antecedent-final.

This feature of 'disappointment' puts it at odds with the predictions of all three systems we have developed so far. In the antecedent-initial case, we've seen that *System 1* allows filtering from the consequent only when the antecedent is negated, whereas *System 2* and the dynamic system never allow filtering. In the antecedent-final case, *Systems 1,2* allow filtering from the consequent, whereas the dynamic system has a choice in the issue, depending on whether the template applies linearly or structurally.

3.7.6. Multiple triggers

The predictions here are essentially the same as those of the dynamic system. In the interest of saving some space, we eschew a fuller exposition.

3.7.7. Summary of predictions

Table 3.17 summarizes the presuppositions predicted by 'disappointment' for the various cases we have been examining in this chapter (excluding as usual multiple triggers), contrasting them with the systems we've developed.

Sentence	System 1	System 2	Dynamic Sem	'Disappointment'
$(p'p\ and\ q)$	$C \models p'$	$C \models p'$	$C \models p'$	$C \models p'$
$((\neg p'p)\ and\ q)$	$C \models q \rightarrow p'$	$C \models p'$	$C \models p'$	$C \models p'$
$(p'p\ or\ q)$	$C \models \neg q \rightarrow p'$	$C \models \neg q \rightarrow p'$	$C \models \neg q \rightarrow p'$	$C \models \neg q \rightarrow p'$
$((\neg p'p)\ or\ q)$	$C \models p'$	$C \models \neg q \rightarrow p'$	$C \models \neg q \rightarrow p'$	$C \models \neg q \rightarrow p'$
$(if\ p'p.\ q)$	$C \models p'$	$C \models p'$	$C \models p'$	$C \models \neg q' \rightarrow p'$
$(q.\ if\ p'p)$	$C \models \neg q \rightarrow p'$	$C \models \neg q \rightarrow p'$	$C \models p'/\neg q \rightarrow p'$	$C \models \neg q' \rightarrow p'$
$(if\ (not\ p'p).\ q)$	$C \models \neg q \rightarrow p'$	$C \models p'$	$C \models p'$	$C \models \neg q \rightarrow p'$
$\neg(p'p\ and\ q)$	$C \models p'$	$C \models q \rightarrow p'$	$C \models p'$	$C \models p'$
$((p'p\ and\ q)\ or\ r)$	$C \models q \rightarrow (p' \vee r)$	$C \models q \rightarrow (p' \vee r)$	$C \models \neg r \rightarrow p'$	$C \models \neg r \rightarrow p'$

Table 3.17: Summary core predictions for System 1 vs System 2 vs Dynamic system vs Disappointment

Empirically, 'disappointment' has a lot going for it. However, its reliance on the Strong Kleene implication leads to unwanted symmetries in the conditional case; for example, if the negation of the consequent entails a presupposition in the antecedent, that presupposition of the antecedent is always filtered, regardless of whether the antecedent is negated or not (cf. the discussion in section 3.2.3.3). Currently, this is the major disadvantage of this approach. As far as negated conjunctions/disjunctions, plus the behavior of conjunctions embedded in disjunctions is concerned, 'disappointment' patterns together with our dynamic system.

3.8. Conclusion

This chapter was an attempt to think about the (a-)symmetries of projection in a principled way. If recent experimental results arguing that conjunction and disjunction really do differ with respect to the availability of symmetric filtering are to be taken into account, then we need a theory that predicts which connectives will be associated with symmetric vs asymmetric filtering. The attempt here focused on taking various intuitions about presupposition projection (bivalent vs trivalent algorithms that operate linearly on strings or recursively on sentences) that are already present in the literature and tweaking them in ways that give symmetric conjunction, but asymmetric disjunction in a predictive way. The predictions for some core cases where then set out and contrasted to one another as well as the currently known empirical landscape. A final comparison was between the three systems developed in this chapter and the 'disappointment' system of George 2008a. All the systems have places where they make distinct predictions, and the plan should be to experimentally test these in order to start knocking out some of the options, and hopefully disentangling the thorny issue of filtering (a-)symmetries.

Chapter 4

Deriving presupposition projection in coordinations of polar questions

[The present chapter has been accepted for publication in *Natural Language Semantics*. References to reviewer comments concern comments/suggestions made by *NALS* reviewers during the review process.]

4.1. Introduction

This chapter is a response to Enguehard 2021, who observes that presuppositions project in the same way from coordinations of declaratives and coordinations of polar questions, but existing mechanisms of projection from declaratives (e.g. Schlenker, 2008, 2009) fail to scale to questions. His solution involves specifying a trivalent inquisitive semantics for (coordinations of) questions that bakes the various asymmetries of presupposition projection into the lexical entry of conjunction/disjunction, and as a result makes the resolution conditions of such polar questions asymmetric.

We argue however that such a move faces both theoretical and empirical issues. On the theoretical side, it suggests that the way to unify the filtering properties of declaratives and questions is to semanticize presupposition and its (a-)symmetries, adopting a trivalent semantics that regulates filtering. This moves away from the Stalnakerian intuition that takes filtering and its (a-)symmetries to derive from the way comprehenders gradually integrate sentences into a context. On the empirical front, we argue that making the semantics asymmetric in order to capture filtering asymmetries in questions leads to wrong resolution conditions, at least for some questions. In contrast to the semantics approach, we pursue a pragmatic alternative, showing that the data can be captured without semanticizing the relevant (a-)symmetries: we adapt the novel pragmatic theory of *Limited Symmetry* (Kalomoiros 2022a) to an inquisitive framework in a way that leaves the underlying semantics for coordinations of polar questions symmetric and bivalent, while deriving the projection data.

The basic intuition underlying our approach is Stalnakerian in origin (building on Phillipe

Schlenker's *Transparency* theory, (Schlenker, 2008)): presupposition is information that is taken for granted, and hence should be ignorable without affecting the truth conditions in a context C. In a conjunction like $(p \wedge q)$, if the presuppositions of q are entailed by p, then all worlds in a context C where p is false are worlds where the whole conjunction is false, regardless of whether q carries any presuppositions. And in worlds where p is true, the presuppositions of q will be satisfied, so the truth value of the sentence will depend solely on the truth value of the assertion of q. In either case, the presuppositions of q play no role in determining the truth value of the conjunction. We argue that the parallel intuition for questions is that presuppositions should not affect the **polarity** of the resolution conditions of a question. Polarity is a notion that tracks the truth conditions of the declarative that underlies a polar questions; in a conjunction like $(?p \wedge ?q)$, the issue raised by the questions is resolved positively in sets of worlds where $(p \wedge q)$ is true, and negatively in sets of worlds where $(p \wedge q)$ is false. Thus, sets of worlds where p is false, if they resolve the issue raised by $(?p \wedge ?q)$, resolve it negatively, no matter whether q carries any presuppositions. And in sets of worlds where p is true, whether the question is resolved positively or negatively depends on whether q is true or false. If p entails the presuppositions of q, then q will never fail in a set of worlds where p is true because of presupposition failure. So, again the presuppositions of q will play no role in deciding the polarity of the resolution of the question.

We formalize this idea within an inquisitive extension of the theory of *Limited Symmetry* (Kalomoiros 2022a). This is a pragmatic, parsing-oriented approach to projection that aims to keep the semantics of the connectives classical (in the spirit of Stalnaker 1974 and Schlenker 2009). It was originally designed as a theory that can derive **asymmetric** conjunction but **symmetric** disjunction from a single mechanism (unlike e.g. Schlenker 2009 who has to postulate distinct mechanisms for symmetry vs asymmetry). The core of our response consists in showing that *Limited Symmetry* lends itself very naturally to an inquisitive extension that derives Enguehard's data.

The rest of the chapter is organized as follows: Section 2 reviews the main issues and data, Enguehard 2021's approach to them, and examines the theoretical and empirical motivations for the alternative pursued in this chapter. Section 3 introduces the theory of *Limited Symmetry*, and shows how it accounts for the projection behavior of declaratives. Section 4 lifts *Limited Symmetry* to an inquisitive framework and proceeds to apply it to Enguehard's data. The main focus is on conjunction (since this is what Enguehard 2021 mostly focuses on as well), but in section 5 we also spell out the system's predictions for disjunctions (which are systematically predicted to be symmetric, in contrast to conjunctions, and in contrast to Enguehard 2021). Section 6 discuses the similarities and differences between our own and Enguehard's approach, as well as the explanatory and theoretical trade-offs involved by putting the asymmetries of presupposition in the semantics vs pragmatics of questions. Section 7 concludes.

4.2. Background

4.2.1. The problem

Basic data Enguehard 2021 (henceforth E) makes the novel observation that coordinations of polar questions behave very similarly to their declarative counterparts in terms of presupposition projection,[77] with the same asymmetry holding in both cases: when the question/declarative in the first conjunct entails the presupposition of the question/declarative in the second conjunct, that presupposition is filtered. However when the question/declarative in the second conjunct entails the presupposition of the question/declarative in the first conjunct, infelicity ensues (in contexts that do not support the relevant presupposition), which is typically attributed to projection:[78]

(1) Declaratives

[77] But see van Rooij 2005 for an interesting precursor that examines the general problem of projection from modal subordination environments, and who considers (among other things) a version of E's data.

[78] E's original paper makes use of the following example:

(i) Is Syldavia a monarchy and is the Syldavian monarch a progressive?

However, when considering the negation of 'Syldavia is monarchy' in the context of negated polar questions, and disjoined questions, E takes the opposite of 'monarchy' to be 'republic', leading to examples like:

(ii) #Is Syldavia a republic and is the Syldavian monarch a progressive?

Native speakers that I consulted found it hard to keep in mind 'monarchy' and 'republic' as polar opposites, as they did not consider these two systems to exhaust the types of government. The examples in the current chapter are still based on the existential presupposition of definites, but instead exploit the 'married' vs 'unmarried' contrast which was judged a lot more straightforward by consultants.

a. **Context:** We have no idea whether or not Emily is married.

b. Emily is married and her spouse is a doctor.

c. #Emily's spouse is a doctor and she is married.

(2) Questions

a. **Context:** We have no idea whether or not Emily is married.

b. Is Emily married and is her spouse a doctor?

c. #Is Emily's spouse a doctor and is she married?

This paradigm crucially shows that the projection problem generalizes across speech acts, setting up a simple (yet hard) challenge for any account of projection that purports to be explanatory: does the explanation for the declarative case generalize to the question case in a straightforward fashion?

The complication of symmetry The problem is compounded by the fact that in classic approaches to the semantics of questions, polar questions receive a symmetric denotation in terms of their resolution conditions. We illustrate this via the inquisitive semantics approach to polar questions (Ciardelli et al. 2013, Ciardelli et al. 2018):

(3) a. Is Mary married?

b. $\{s |\ s \vdash \ulcorner\text{Mary is married}\urcorner\ \textit{or}\ s \vdash \ulcorner\text{Mary is unmarried}\urcorner\}$

The idea behind the inquisitive denotation in (3b) is that the resolution conditions of a polar question should be states (where a state is a set of possible worlds) which provide a **complete** answer to the question. Thus, the resolution conditions for the question in (3a) will consist of states which support the sentence 'Mary is married' and states which support that 'Mary is unmarried', as in both kinds of state the question is fully resolved (in inquisitive semantics, a state s supports ($\vdash$) an inquisitive sentence p iff $|p|$ is true in all worlds in s, where $|p|$ is the classical proposition associated with p). While the states perspective is based on the inquisitive semantics approach to question meanings, both Karttunen/Hamblin semantics (Hamblin, 1976; Karttunen, 1977) and partition semantics (Groenendijk & Stokhof, 1984) essentially pursue a similar idea (see E for details). For the purposes of this reply, we will be focusing on the inquisitive approach.

Given the above, positive and negative polar questions are predicted to have the same resolution conditions; and the same holds for the 'or not' counterparts of positive polar questions:

(4) a. Is Emily married?
b. Is Emily unmarried?
c. Is Emily married or not?
d. $\{s|\ s \vdash \ulcorner$Emily is married$\urcorner$ *or* $s \vdash \ulcorner$Emily is unmarried$\urcorner\}$

As E points out, if (4d) is the denotation of all the polar questions in (4a)-(4c), then these should be interchangeable in the paradigm in (2). However, the intuitive judgment is that this is not the case; examples (5c)-(5d) are infelicitous:

(5) a. **Context:** We have no idea whether Emily is married.
b. Is Emily married and is her spouse a doctor?
c. #Is Emily unmarried and is her spouse a doctor?
d. #Is Emily married or not, and is her spouse a doctor?

The outcome of all this, according to E, is that any account of the asymmetry of the projection data in (2) cannot be based on the resolution conditions semantics for polar questions, as this semantics is not fine-grained enough to differentiate between positive and negative versions of a polar question (as the data in (5) seem to require). Moreover, E shows that the resolution conditions semantics is also inadequate in an even more fundamental respect: combined with current explanatory accounts of presupposition projection for declaratives (Schlenker 2008, Schlenker 2009, George 2008b) it leads to wrong results for projection from coordinations of polar questions. To properly see this, a brief foray into Schlenker 2008 is required.

4.2.2. Schlenker 2008

Motivations The filtering asymmetry in declaratives, (1), has generated a lot of debate: Stalnaker's original suggestion was that presuppositions express information that is redundant (already part of the common ground) (Stalnaker, 1974). From this perspective, the asymmetry of conjunction can be derived pragmatically as follows: interpretation is rooted in the inherently left-to-right nature of incremental processing; as a conjunction is incrementally interpreted, we get access to the initial conjunct first, and we add it to the context; thus, when we get access to the second conjunct, this gets interpreted against a set of worlds that entails the first conjunct. So, if the first conjunct contains a presupposition that is not established in the common ground, then that presupposition is not redundant, but rather quite informative. But if the second conjunct carries a presupposition that is entailed by the first conjunct, then this presupposition plays no informative role in adding the second conjunct to the context; the context already entails it.

While explanatorily powerful, this way of thinking did not generalize straightforwardly to other connectives; in turn, this led to the dynamic approach of Heim 1983b, which put the relevant asymmetries into the lexical entry of the connectives: for instance conjunction is asymmetric because it denotes a function that updates a context C **first with the initial conjunct**. Despite the gains in empirical coverage, the dynamic approach was criticized for semanticizing the asymmetries: if we can write a lexical entry for conjunction that updates with the initial conjunct first, then we can write an entry that updates with the second conjunct first; nothing in the formalism forces one option over the other (Soames 1989 a.o.).

More recently, there have been attempts to retain the explanatoriness of Stalnaker's intuition within a theory that keeps the empirical coverage of dynamic semantics (Schlenker, 2008, 2009; Rothschild, 2011). Schlenker 2008's *Transparency* theory represents one influential attempt along these lines: its aim is to formalize the idea that a presupposition must be redundant in a way that is predictive across connectives. Since this is the approach that E takes to represent his baseline for an explanatory theory of projection, it's worth presenting the basic idea.

Assumptions and mechanics Let's assume that presuppositions triggers are separable into a presupposition component and into an assertion component. For instance, 'John stopped smoking' presupposes that 'John used to smoke' and asserts that 'he currently doesn't smoke'. Given this, Schlenker 2008 assumes a formal language with atomic sentences of the form $p'p$, where p' is the presupposition and p the assertion. These will be interpreted conjunctively, assuming an underlyingly bivalent and classical semantics, so $p'p$ is true in a world w iff p' is true and p is true.[79,80]

Schlenker's Transparency idea takes the Stalnakerian intuition about redundancy quite literally: a sentence r is Transparent in the position of a sentence D embedded in a sentence $S = \alpha D \beta$ (where α and β are the substrings of S on the left and right of D) iff conjoining r to D doesn't change the truth conditions of S for any D:

(6) **(Symmetric) Transparency:** Given a context C, a sentence r and sentence $S = \alpha D \beta$ (where α and β are substrings of S on the left and right of D), then r is *transparent in the position of D* iff the following holds:

- For all D: $C \models \alpha\ (r \wedge D)\ \beta \leftrightarrow \alpha\ D\ \beta$

Therefore, sentences that are transparent in the position of D are redundant: adding them or removing them doesn't change the truth conditions. Given a presuppositional sentence $p'p$ embedded

[79] The assumption that presuppositions are separable from the other entailments of a sentence is implicit in a lot of work on presupposition. For instance Karttunen 1974 talks about the 'atomic presuppositions' of a sentence. Moreover, presupposition-triggering algorithms (e.g. Abrusán 2011), assume that a presupposition starts as an entailment that gets marked as a presupposition. One then can view the p' in $p'p$ as precisely this entailment to be marked as a presupposition (hence the prime). Nevertheless, it should be noted that this is probably an idealization, and that sometimes separating the entailment which is to be presupposed is not as straightforward (cf. Schlenker 2010). Nonetheless, we think it's a useful idealization, and we will end up adopting it in our system as well.

[80] An anonymous reviewer wonders under what assumptions this could be made to work in a direct interpretation framework, suggesting that this might require taking presupposition triggers to be syntactically complex in the object language. I share the sense that if one wanted to use this system to directly interpret a more naturalistic syntax, then taking triggers to form syntactic complexes of the form *presupposition + assertion* would probably be required. In the case of triggers like factive verbs (e.g. 'know') there is a sense in which the presuppositional component is already syntactically separable as it appears in the form of a CP complement to the factive verb. For triggers like 'stop' one might end up having to postulate the required syntactic complexity, but take the presuppositional component of 'stop' to be unpronounced. For current purposes I leave this issue aside.

in S, p' then is restricted to be redundant information, in the sense that it is restricted to be transparent in the position of p.

To get a sense of how this works, consider $p'p$. Transparency requires that p' should be transparent in the position of p. This is satisfied just in case $C \models p'$. To see this, consider what the constraint requires in a context C:

(7) For all p: $C \models p'p \leftrightarrow p$

Suppose (7) holds. Then it holds for all p, so specifically it holds for p $\top$, where $\top$ is a tautology. Then, the condition becomes:

(8) $C \models p'\top \leftrightarrow \top$

Recall that $p'p$ is interpreted conjunctively, so the condition becomes:

(9) $C \models p'$

For the other direction, suppose that (9) holds. Then, it's easy to see that (7) also holds. This therefore derives that a presupposition p' of a sentence $p'p$ must be entailed by the global context.

As it stands in (6), the definition of *Transparency* is symmetric, in the sense that information that comes after the presupposition trigger $p'p$ can be used to check if p' is redundant in S. For instance applied to a conjunction like ($p'p$ *and* q), Transparency demands that:

(10) For all p: $C \models (p'p \textit{ and } q) \leftrightarrow (p \textit{ and } q)$.

Going through the relevant calculations, one can show that this holds just in case $C \models q \rightarrow p'$, i.e. the second conjunct (contextually) entails the presupposition of the first conjunct. To derive the asymmetry associated with conjunction, Schlenker 2008 proposes an asymmetric version of Transparency whereby r is redundant in the position of D just in case $(r \wedge D)$ can be replaced with D (for any D) **no matter what follows** D **in** S. Applied to the case of $p'p$, this forces the p' component of p' to be redundant in S no matter what follows $p'p$. The idea is that as soon a comprehender encounters a presupposition trigger from left to right, they check if it is redundant no matter what follows. The sentence suffers presupposition failure if that is not the case:

(11) **(Asymmetric) Transparency:** Given a context C, a sentence r and sentence $S = \alpha\ D\beta$ (where α and β are substrings of S on the left and right of D), then r is *transparent in the position of* D iff the following holds:

- For all D, for all β: $C \models \alpha\ (r \wedge D)\ \beta \leftrightarrow \alpha\ D\ \beta$

Note how now the constraint quantifies universally over all possible continuations (good finals) of S after $p'p$. To get a sense of how this works, consider the case of $S = (p'p\ \mathit{and}\ q)$. We can show that Transparency is satisfied just in case $C \models p'$. The constraint demands that:

(12) For all p, for all β: $C \models (p'p\ \beta \leftrightarrow (p\ \beta$

Suppose that this holds. Then it must hold for $p = \top$ and $\beta = \mathit{and}\ \top)$.[81] Then the condition becomes:

(13) For all p: $C \models (p'p\ \mathit{and}\ \top) \leftrightarrow (p\ \mathit{and}\ \top)$

This last expression is clearly equivalent to:

[81] Note that β is a variable over substrings.

(14) For all p: $C \models p'p \leftrightarrow p$

As we saw earlier, this holds just in case $C \models p'$. For the other direction, suppose that $C \models p'$. Then $p'p$ is equivalent to p in C for all p, so substituting $p'p$ for p in a larger sentence will not affect the truth conditions for any p.

On the other hand, in a sentence like $(p \wedge q'q)$, things are fine as long as $C \models p \rightarrow q'$. The reason is that in a conjunction, the first conjunct is always transparent in the position of the second conjunct, so $(p \wedge q'q) \equiv (p \wedge (p \wedge q'q))$. Since $p \models q'$, this is equivalent to $(p \wedge q)$, which means that the q' can be removed without any change to the truth conditions for any q (see Schlenker 2007, Schlenker 2008 for more details).[82]

[82] An interesting thing to note here is that the strategy of quantifying over possible continuations as a way of making a projection system asymmetric isn't necessarily tied to the particularities of *Transparency*. As pointed out in Fox 2008 (see also Chemla & Schlenker 2012) one can use this strategy to incrementalize more familiar trivalent accounts of projection, (Kleene 1952, Peters 1979, Beaver & Krahmer 2001, George 2008a. Suppose that one starts with the traditional Strong Kleene system, which is fully commutative in its base semantics. For example, here's Strong Kleene conjunction:

(i)

$p \wedge q$	T	F	$\#$
T	T	F	$\#$
F	F	F	F
$\#$	$\#$	F	$\#$

Then one can add a constraint like the following:

(ii) Given a sentence $S = (\alpha * \beta)$, where $*$ is a binary connective, if it's the case that α receives the $\#$ value in some world w, and it's the case that for all possible constituents γ the truth value of $(\alpha * \gamma)$ is constant in w (according to the Strong Kleene table), then assign to S that truth value. Otherwise, assign to S the value $\#$. If α doesn't receive the $\#$ value, then the value of the entire sentence is the one given by the Strong Kleene table.

In this constraint, good finals are thought of as possible constituents that can substitute for the second argument in $(\alpha * \beta)$, and as such the constraint has a more structural nature than the *Transparency* constraint, where good finals are substrings. However, the effects are similar: by applying this constraint to the Strong Kleene tables, one gets the so-called Middle Kleene tables. For example, in $(\alpha \wedge \beta)$, if α is $\#$ in some w, then there are continuations that make the sentence both 0 (take $\beta = 0$) and $\#$ (take $\beta = \#$). So, the truth value of the sentence isn't constant regardless of continuation in w, and the sentence receives the $\#$ value. The full Middle Kleene table for conjunction looks as follows:

(iii)

$p \wedge q$	T	F	$\#$
T	T	F	$\#$
F	F	F	F
$\#$	$\#$	$\#$	$\#$

Upshots Note how this kind of constraint puts no asymmetry in the semantics, which has remained fully commutative and bivalent. Presupposition failure results from a pragmatic constraint that is inspired by the idea that comprehenders evaluate whether a presupposition represents redundant information contextually as soon they encounter the relevant trigger in interpreting the sentence from left to right. Thus, Schlenker 2008 derives the asymmetry of conjunction, while keeping the semantics fully symmetric. His theory represents a major advance in providing an account of projection that is explanatory and fully general at the same time.[83,84] Given the theory's success, it's natural to wonder if it can be extended to the questions data. E argues that it cannot.

4.2.3. The tripartition requirement

Language and semantics To see why Transparency will not work to derive presupposition filtering in a conjunction of questions like $(?p \wedge ?q'q)$, let's spell out some assumptions about the language and its semantics. Assume the following language $\mathcal{L}$:

(15) $\phi := \ p_i \mid p'_j p_k \mid \top \mid \ \bot \ \mid \neg\phi \mid (\phi \wedge \phi) \mid (\phi \vee \psi) \mid \phi \rightarrow \psi \mid ?\phi$ (indices are natural numbers and are omitted below)

The semantics of this language is a garden-variety inquisitive semantics (Ciardelli et al. 2013, Ciardelli et al. 2015 a.o.), that specifies the conditions under which a state s (a set of worlds) supports ($\vdash$) an $\mathcal{L}$-sentence:

[83] That is not to say that there aren't issues. In particular the case of connectives that behave symmetrically (e.g. disjunction) forces Schlenker to say that both symmetric and asymmetric Transparency are available, with asymmetric Transparency being the preferred default as it follows the order imposed by incremental interpretation. However, recent experimental results suggest that symmetry is not available to the same extent for all connectives: it is much more readily available in disjunctions than in conjunction; this constitutes a challenge for the idea that all connectives have access to both kinds of Transparency. In this respect, some of the questions that arise in Heim's theory reappear, in the form of what conditions the choice of one kind of local context over the other. It is exactly this kind of problem that *Limited Symmetry* was originally designed to solve. See section 3 for some more discussion of this, as well as Kalomoiros & Schwarz (2021, Forth).

[84] Schlenker 2009 proposes an equivalent formulation of these ideas in the form of his *Local Contexts* theory. The idea behind that reformulation is that the Karttunen-Heim notion of 'local context' (Karttunen, 1974; Heim, 1983b) can be re-conceptualized as the strongest proposition r that one can conjoin to a constituent E such that $\alpha(r \textit{ and } E)\beta$ is equivalent to $\alpha E \beta$, for all E, and for all β (it should be clear that this requires r to be asymmetrically transparent with respect to E). Since the theory that we will use to develop our own ideas in this chapter is much more transparently connected to *Transparency Theory* than to *Local Contexts*, we limit our presentation here to *Transparency*. See (Schlenker, 2009) for more details on *Local Contexts*.

(16) •$s \vdash p$ iff for every $w \in s$, $|p|$ is true

•$s \vdash p'p$ iff $s \vdash p'$ and $s \vdash p$

•$s \vdash \top$ iff $s \subseteq W$ (where W is a set of worlds)

•$s \vdash \perp$ iff $s = \emptyset$

•$s \vdash \phi \wedge \psi$ iff $s \vdash \phi$ and $s \vdash \psi$

•$s \vdash \phi \vee \psi$ iff $s \vdash \phi$ or $s \vdash \psi$

•$s \vdash \phi \rightarrow \psi$ iff $\forall t \subseteq s$:

if $t \vdash \phi$ then $t \vdash \psi$

•$s \vdash ?\phi$ iff $s \vdash \phi \vee \neg\phi$

•$s \vdash \neg\phi$ iff $s \vdash \phi \rightarrow \perp$

A couple of notes: First, since a state s supports p iff the classical proposition associated with p (namely $|p|$) is true in all worlds in s, the empty state supports any p. Second, a state s supports $\neg\phi$ iff there are no non-empty subsets of s that support ϕ.

Given the semantics above, $(?p \wedge ?q)$ denotes a set that contains four different kinds of states (we will call this set the *quadripartition* following E):

(17) $\{s \mid s \vdash p \textit{ or } s \vdash \neg p\} \cap \{s \mid s \vdash q \textit{ or } s \vdash \neg q\}$.

This is equivalent to:

(18) **Quadripartition denotation:** $\{s \mid (s \vdash p \textit{ and } s \vdash q) \textit{ or } (s \vdash p \textit{ and } s \vdash \neg q) \textit{ or } (s \vdash \neg p \textit{ and } s \vdash q) \textit{ or } (s \vdash \neg p \textit{ and } s \vdash \neg q)\}$

A conjunction of polar questions then denotes a partition of the context into states where both p and q holds, states where p holds but q doesn't hold, states where p doesn't hold but q holds, and finally states where neither p nor q hold. Under an approach to question meaning as resolution conditions, this makes sense. In each kind of state, we are able to give a complete answer that resolves the question arising from conjoining the questions $?p$ and $?q$.

Applying Transparency To apply Transparency to questions, we need a notion of equivalence between questions. Following E, we take two questions to be equivalent just in case they denote the same set of states (contextually). We can now check whether we can use Transparency to derive filtering conditions. Specifically, we want to know if in a sentence like $(?p \wedge ?q'q)$ the presupposition q' gets filtered when p (contextually) entails q' (all the states that support p support q'). Transparency imposes the condition that for all q the denotations of $(?p \wedge ?q'q)$ and $(?p \wedge ?q)$ are equivalent. The inquisitive denotations for these two sentences in a context C are:

(19) $(?\mathbf{p} \wedge ?\mathbf{q'q})$: $\{s \subseteq C |\ s \vdash p\ or\ s \vdash \neg p\} \cap \{s |\ s \vdash q'q\ s \vdash \neg q'q\} = \{s \mid (s \vdash p\ and\ s \vdash q'q)\ or\ (s \vdash p\ and\ s \vdash \neg q'q)\ or\ (s \vdash \neg p\ and\ s \vdash q'q)\ or\ (s \vdash \neg p\ and\ s \vdash \neg q'q)\}$

(20) $(?\mathbf{p} \wedge ?\mathbf{q})$: $\{s \subseteq C |\ (s \vdash p\ and\ s \vdash q)\ or\ (s \vdash p\ and\ s \vdash \neg q)\ or\ (s \vdash \neg p\ and\ s \vdash q)\ or\ (s \vdash \neg p\ and\ s \vdash \neg q)\}$

Using the fact that $p \models q'$, we can re-write (19) as:

(21) $(?\mathbf{p} \wedge ?\mathbf{q'q})$: $\{s \subseteq C |\ (s \vdash p\ and\ s \vdash q)\ or\ (s \vdash p\ and\ s \vdash \neg q)\ or\ (s \vdash \neg p\ and\ s \vdash q'q)\ or\ (s \vdash \neg p\ and\ s \vdash \neg q'q)\}$

Now consider a q such that $|q|$ is not related by (contextual) entailment to either $|p|$, or $|\neg p|$, or $|q'|$, or $|\neg q'|$. This means that there are worlds where $|q|$ is true, and $|p|$ is false and $|q'|$ is false. Also, there are worlds where $|q|$ is false and $|p|$ is false and $|q'|$ is false.[85] Take a world w of the first kind, and a world w' of the second kind, and form the set $\{w,\ w'\}$. This is a state that supports $\neg p$ and $\neg q'$, so it is in the denotation of $(?p \wedge ?q'q)$. However, it is not in the denotation of $(?p \wedge ?q)$: while the state supports $\neg p$, it supports neither q nor $\neg q$. Therefore, for this q, the two denotations are not the same.

The tripartition to the rescue This is an undesirable result, as clearly q' gets filtered in the second conjunct of a conjunctive question when p entails it. Are there ways to get to the required filtering conditions? In fact, E argues that the only way for $p \models q'$ to guarantee the filtering of q'

[85] If there were no such worlds, then all worlds where $|q|$ is false would be worlds where either $|p|$ is true or $|q'|$ is true; that is $|\neg q| \models |p \vee q'|$. Since $|p| \models |q'|$, this is equivalent to $|\neg q| \models |q'|$, which is equivalent to $|\neg q'| \models |q|$, which violates the assumption that $|q|$ and $|\neg q'|$ are not related by contextual entailment.

is if conjunctive questions have the form $?(p \wedge ?q)$. In this case, a conjunctive question denotes a ***tripartition***:

(22) **Tripartition denotation:** $\{s \mid (s \vdash p \textit{ and } s \vdash q) \textit{ or } (s \vdash p \textit{ and } s \vdash \neg q) \textit{ or } (s \vdash \neg p)\}$

Going through the relevant computations reveals that if $p \models q'$, then $?(p \wedge ?q'q)$ and $?(p \wedge ?q)$ have the same denotation for all q (see E's original paper for more details). This gives us the correct filtering conditions.

However, as E points out, $?(p \wedge ?q)$ does not represent the syntax that questions like (2) arguably have: they are conjunctions of questions, not questions of the conjunction of a declarative with a question (see E's paper for an elaboration of this criticism). Thus, E aims to develop an account that essentially makes a conjunctive polar question denote the tripartition in (22), while retaining the syntactic intuition that we are dealing with a conjunction of questions.

4.2.4. Enguehard 2021's account

E states his solution in a framework where questions denote trivalent inquisitive predicates:

(23) $$?p = \lambda s. \begin{cases} 1, \text{if } s \vdash p \\ 0, \text{if } s \vdash \neg p \\ \#,\ \text{otherwise} \end{cases}$$

This predicate of states maps a state s to 1 if s supports p, to 0 if s supports the negation of p, and to # otherwise. The # case is meant to capture the cases where either: **i)** s contains a mix of worlds, where in some p is 1 while in others 0; **ii)** the presuppositions of p fail. Here's the intuition behind this move: a polar question $?p$ partitions the context into resolution and non-resolution states: the first kind of state is a state that supports either p or $\neg p$. In these cases the issue raised by the question is resolved, positively or negatively. In the second kind of state the issue raised is not resolved, either because the sate is mixed or gives rise to presupposition failure.

E formalizes this within a fully trivalent system in which presupposition failure for both declaratives and questions is modeled as #. However, as he points out, the choice matters only in the case of questions. Simple declaratives could receive an analysis within Schlenkerian *Transparency/Local Contexts*. Furthermore, note that the denotation in (23) assigns different denotations to positive vs negative polar questions, as the negative polar questions map states that support p to 0, and states that support $\neg p$ to 1. This breaks the symmetry between positive and negative polar questions (as well as 'or not' questions) and allows E to account for the asymmetries in (5).

Given this, here's his definition for a coordination of polar questions:

(24) $$?p \wedge ?q = \lambda s. \begin{cases} 1, \text{if } s \vdash p \text{ and } s \vdash q \\ 0, \text{if } s \vdash \neg p, \text{ or } s \vdash p \text{ and} s \vdash \neg q \\ \#, \text{ otherwise} \end{cases}$$

The important thing to note here is that collecting the states that are being mapped to 1,0 by this trivalent predicate creates the tripartition in (22). The conjunction of two polar questions $?p$ and $?q$ is resolved positively in states that support the truth of p and q; negatively in states that support the falsity of p, or the truth of p and the falsity of q. States that include worlds where p is undefined are mapped to #, as are states that support p but where q is undefined. This makes conjunction of polar questions follow a Middle Kleene logic which derives the desired asymmetry of projection (see also fn 82). When does $(?p \wedge ?q)$ map a state s to a classical truth value (and hence doesn't suffer from presupposition failure)? Either p or $\neg p$ must be supported by s (so the presuppositions of p must be satisfied in s); and if s supports p, then s must also support either q or $\neg q$, so in both cases q must not receive the # value (which is equivalent to saying that all the states that support p must not cause presupposition failure for q, so p entails the presuppositions of q). These are the desired filtering conditions.

Apart from leading to correct filtering properties, an additional important motivation put forth by E for the denotation in (24) is the predictions it makes for what kinds of answer resolve the issue raised by a conjunction of polar questions like (2), repeated here as (25a):

(25) a. Is Emily married and is her spouse a doctor?

b. *Emily is not married.*

c. *Emily is married and her spouse is not a doctor.*

d. *Emily is married and her spouse is a doctor.*

According to the tripartitive denotation, (25a) is resolved by states where Emily is married and her spouse is a doctor (i.e. states that support p and q), states where Emily is unmarried (ie. they support $\neg p$), and finally states where Emily is married and her spouse is not a doctor (i.e. states that support p and $\neg q$). The point is that considering the case where both Emily is unmarried and Emily's spouse is not a doctor, is not needed; knowing that the proposition underlying the first conjunct fails is enough to resolve the question negatively. This is captured by the asymmetric denotation in (24), as $\neg p$ *and* $\neg q$ simply does not appear as a case where the question returns 0; knowing that $\neg p$ is enough. To the extent then that E is right is arguing that a conjunction of polar questions is fully resolved by the tripartition, this provides an additional empirical argument for moving away from the quadripartitive denotation.

Summarizing, the main claim is that putting classical accounts of polar questions together with a pragmatic theory of presupposition projection like Schlenker 2008 does not lead to a satisfactory account of the projection data in polar questions.[86] E's solution is to treat polar questions as trivalent inquisitive predicates that follow a Middle Kleene logic, thus accounting for the filtering patterns; the same trivalence makes $?p$ (positive polar), $?(\neg p)$ (negative polar), $?p \vee ?(\neg p)$ ('or not') questions denote different objects, hence accounting for their non-substitutability (see E for the details).

[86]E extends this claim to trivalent accounts of presupposition projection like George 2008a. The point is that trivalence ends up operating on the question level in E's theory, and not just at the declarative level.

4.2.5. Why look for an alternative?

Theoretical Perspective E claims that the core intuition behind his analysis is that a question Q should be associated with positive and negative answers (states mapped to either 1 or 0 respectively in his analysis), and that whether a state counts as positive or negative depends on whether the proposition related to Q is True or False in that state. We agree with this core intuition, and in fact our own reanalysis of the phenomenon will rely on a similar notion of positive vs negative resolution to a question. However, E's approach puts this notion of positivity vs negativity directly into the semantics. A consequence of that is that the asymmetry of conjunction is also semanticized, with conjunction no longer being commutative. One can then repeat the same question posed in the original asymmetry debate reviewed above: are the asymmetries of 'and' with respect to projection something to bake into the lexical entry, or are they to be derived from more general pragmatic mechanisms (which leave the basic conjunction semantics commutative, reintroducing the notion of positive vs negative resolution in the pragmatics)?

In addition, while E claims that a *Transparency/Local Contexts*-style pragmatic approach will not work for (bivalent denotations of) questions, he sketches the possibility that *Transparency/Local Contexts* could apply to both declaratives and questions, with the condition that while declaratives would receive a classical bivalent semantics, questions would crucially continue to receive a Middle Kleene trivalent semantics. However, this would be a case where *Local Contexts* **derives** the filtering conditions of declaratives, but **restates** the filtering conditions of questions, since the underlying trivalence already encodes the filtering conditions of questions (i.e., *Local Contexts* would be explanatory only for declaratives). Such a move would substantially weaken the parallelism between projection from declaratives and projection from questions at the theoretical level. If we think that it is desirable for the declarative data and the question data to receive parallel **explanations**, and if we also think that there is merit (explanatory or otherwise) to the pragmatic, Stalnaker-style approach to projection that *Local Contexts* aims to formalize, then it becomes interesting to inquire whether we can have a successful pragmatic theory of projection that keeps the semantics bivalent across the board, and scales across speech acts.

Empirical Perspective In additional to theoretical consequences, the point about whether the asymmetry of 'and' needs to be semanticized or not, also has empirical consequences. In this respect, I want to set up an empirical challenge for the view that makes conjunctions of questions denote the tripartition directly. E himself notes that there are cases where a conjunction of questions seems to denote the quadripartititon, and entertains the possibility that the quadripartitive denotation coexists with the tripartitive one (see his paper for details), with context determining which one is called for in a particular case. However, he maintains that when there is a presupposition trigger, it **forces** the tripartition, as in (25a) (otherwise filtering will not come out right). But consider a minimal variations of (25a), which show filtering, while simultaneously calling for a quadripartition in terms of their complete answers:

(26) a. **Context:** I'm visiting Emily's house, and I see a full pack of Marlboro cigarettes in the dustbin in her office. I have no idea if Emily has ever smoked, so I ask her spouse:

b. Did Emily use to smoke Marlboros and has she stopped smoking?

c. (i) # Emily did not use to smoke Marlboros

(ii) ✓Emily has never smoked.

(iii) ✓Emily didn't use to smoke Marlboros (although she was a smoker), and she has stopped smoking.

(iv) ✓Emily didn't use to smoke Marlboros (although she was a smoker), and she hasn't stopped smoking.

(27) a. **Context:** Emily has left for an educational program somewhere in Europe. Possible destinations included Paris and Strasbourg in France, Amsterdam and Utrecht in the Netherlands. I have no idea where she ended up going, but one day I heard one of her friends chatting to someone on the phone in French. So, I asked them:

b. Is Emily in Paris and is she happy that she's in France?

c. (i) # Emily is not in Paris.

(ii) ✓Emily is not in France.

(iii) ✓Emily isn't in Paris (although she is in France), and she is happy to be in France.

(iv) ✓Emily isn't in Paris (although she is in France), and she is not happy to be in France.

The examples in (26b) and (27b) have the same form as (25a), the only difference being that in (25a), the (proposition underlying) the first conjunct is equivalent to the presupposition of the second conjunct (i.e. that Emily is married), but in (26b)/(27b) the first conjunct asymmetrically entails the presupposition of the second conjunct (i.e., that Emily used to smoke/Emily is in France). Focusing on (26) for the moment, the effect is that just negating the first conjunct does not constitute a complete answer to the question, as indicated in (26c)-(i); instead a complete answer where the first conjunct is negated somehow needs to address the issue raised by the second conjunct as well: either by denying the presupposition of the second conjunct that Emily used to smoke, (26c)-(ii), or by saying that Emily used to smoke and currently does(n't), (26c)-(iii) - (26c)-(iv).

E doesn't consider this type of example, but given his commitment to the tripartition for (25a), the prediction is that (26c)-(i) should be a complete answer for (26b). The prediction of the tripartitive denotation is that a sentence denying just the first conjunct should fully address the issue raised by the question, as states that support that negation are mapped to 0. But as we just saw, this is not the case. The example in (27) illustrates the same point with a different presupposition trigger, showing that the observation here is quite general.

It is instead more plausible that conjunctions like (25a), (26b) and (27b) actually do have quadripartite answerhood conditions, but in a case like (25a) replying negatively to the first conjunct addresses the issue raised by both conjuncts (if Emily is not married then there is no need to inquire about her spouse's occupation), so Gricean considerations of quantity apply: answers that address the second conjunct explicitly end up being redundant. However, when just resolving the issue raised by the first conjunct negatively is not enough to also address the issue raised by the second conjunct, then a complete answer requires further specification, which in turn is determined by the quadripartion. This would then be an empirical argument that the tripartition required to capture presupposition filtering should be operative at a pragmatic, not semantic, level.

The purpose of the rest of this response is to show that such a pragmatic theory of projection is indeed possible: it retains a classical bivalent semantics for polar questions, where conjunction is commutative, and derives the projection data for questions and declaratives in a parallel way. We turn to this theory below.

4.3. Limited Symmetry: The classical system

Language and Semantics *Limited Symmetry* is a novel pragmatic theory of presupposition projection that aims to provide an explanatory and predictive account of the phenomenon.[87] Its main appeal comes from the fact that it derives asymmetric filtering for conjunction but symmetric filtering for disjunction **through a single mechanism** (thus accounting for the experimental results in chapter 2). As such, the theory can handle contrasts like the following without positing two different filtering mechanisms, one symmetric and one asymmetric (see e.g. Schlenker 2009, Rothschild 2011):

(28) a. **Context:** We have no idea if Emily is married.

b. #Emily's spouse is a doctor and Emily is married

c. ✓Either Emily's spouse is a doctor or Emily is not married.

Here we give a brief introduction to the propositional version of the system. We then proceed to 'lift' the theory to an inquisitive semantics in section 4. We begin with a simple propositional language $\mathcal{L}^-$ (adapted from Schlenker 2008) that includes only conjunction, disjunction and negation, as well as atomic propositional constants (both presuppositional and non-presuppositional):

(29) $\phi := \ p_i \mid p'_j p_k \mid \top \mid \ \bot \ \mid \neg\phi \mid (\phi \wedge \phi) \mid (\phi \vee \phi)$ (indices are natural numbers and are omitted below)

[87] Here we present a version of *Limited Symmetry* that is formalized enough to make the main ideas clear, but is not meant to be comprehensive. For a more comprehensive statement of the theory, see chapter 3.

The semantics for this language is classical (fully bivalent, with no asymmetry encoded in the semantics). As before, $p'p$ represents an atomic formula with a presuppositional part (p') and a non-presuppositional part (p); its interpretation is conjunctive. We will also assume that that $\mathcal{L}$ is expressive enough to have atomic constants for tautologies and and contradictions, $\top$ and $\bot$ respectively.

Intuitions Recall Schlenker's symmetric Transparency theory where a sentence S doesn't suffer from presupposition failure as long as for each $p'p$ in S, the version of S with $p'p$ and the version of S with $p'p$ replaced by p have equivalent truth conditions for all p. It will be convenient to adopt the notation $S_{p'p/p}$ for the version of S where $p'p$ has been replaced by p (see below for more precise statement of this). Then Transparency amounts to requiring that for every $p'p$ in S:

(30) $\forall p: \; C \models S \leftrightarrow S_{p'p/p}$

It's useful to break this biconditional down to the following two conditionals:

- $S \rightarrow S_{p'p/p}$
- $\neg S \rightarrow \neg S_{p'p/p}$ (the contrapositive of $S_{p'p/p} \rightarrow S$)

Thinking in terms of worlds, the first conditional says that all the worlds in the context where S is true are worlds where $S_{p'p/p}$ is true (for all p). The second conditional says that all the worlds where S is false are worlds where $S_{p'p/p}$ is false (for all p).

Limited Symmetry starts from the idea that this formulation of presupposition failure is essentially correct. However, compreheders in parsing a sentence S do not wait until the end of S in order to check whether this equivalence obtains. Instead, they are playing a Stalnakerian game, where they try to categorize worlds in their context as true vs false. They aim to be fast at this, so in parsing S they are constantly looking to isolate subsets of the context where S is already true/not true, so that they can categorize the worlds in them accordingly, and also so as not to have to worry about those worlds in subsequent truth/non-truth calculations (I assume, following

Schlenker 2009 that the less worlds they have to categorize as they are incrementally interpreting S the easier the overall categorization task becomes). As comprehenders get incremental access to these sets of worlds where at some point in the parse S is already true/not true, they check as much of the Transparency equivalence as they can based on where they know the sentence to be already true/not true. For example if they are at a point where they already know a set of worlds where S is true, they check whether those worlds are also included in the worlds where $S_{p'p/p}$ is already true (in so far as this can be known at that point in the parse). Similarly for falsity. Essentially, comprehenders are 'building' the equivalence required by Transparency in real time, as they are processing a sentence from left to right.

Presupposition failure results if at some point in the parse there are worlds where we know that S is already true/false, but these worlds are not (perhaps yet) worlds where $S_{p'p/p}$ is already true/false. A clarification is in order here:[88] it's possible that in the presence of such worlds, the comprehender could simply keep them in memory, move on with parse and check again if after parsing a bit more of the sentence then these worlds are worlds where both S and $S_{p'p/p}$ are true. Such a strategy is consistent with the fact that the overall requirement on presuppositions is symmetric (not asymmetric) Transparency. On such a view, 'real' presupposition failure is if Transparency fails once one has access to the entirety of S. However, I assume that such 'delayed' satisfaction comes with a cost of having to keep these worlds 'in memory', and as such entails a processing cost. The ideal situation that carries no cost is if at every parsing point, for all p, the worlds where S is already true/false are worlds where $S_{p'p/p}$ is already true/false. Therefore, our formalization below presents the failure of this ideal situation as a hard constraint on acceptability, even though the intention is that that such a constraint is violable given a processing cost.

Formalization A core driving force in *Limited Symmetry* is that sentences are parsed from left-to-right, symbol by symbol; the basic symbolic parsing units are: p_i (simple atomic formulas), $p_j p_k$ (presuppositional atomic formulas), $\neg$, $\wedge$, $\vee$, and the parentheses (,). We thus gain access to progressively larger partial syntactic structures. So for a sentence like $(p'p \wedge q)$, we start with the

[88] See also fn 55 on the same point, and its relation to different ways of thinking about the strength of the requirements that *Limited Symmetry* imposes.

parenthesis (; then we parse $p'p$, then $\wedge$, then q and finally the closing parenthesis. We can collect these **parsing steps/points** in a list: [`(`, `(p'p`, `(p'p ∧`, `(p'p ∧ q`, `(p'p ∧ q)`].[89] The i-th element of such a list for a sentence S will be referred to as the i-th parsing step/point of S, and will be notated as $(S)_i$.

Following the Stalnakerian intuition described above, at each parsing step we are trying to decide in what worlds in the context C, the sentence is already true or not true regardless of continuation.

For instance, for $S = (p'p \wedge q)$, at parsing step $(S)_3 =$ `(p'p ∧` we know that the sentence is already false in all worlds where $p'p$ is false; it doesn't matter what follows, since we are dealing with a conjunction, which means that as long as we know that the first conjunct is false, the whole conjunction is false.

For any $\mathcal{L}$-sentence S then, at any i-th parsing point $(S)_i$, we can define sets of worlds where S is true or not true in the context C no matter what good final d (Schlenker 2009)) follows $(S)_i$:[90]

(31)
- $\mathbb{T}_i^S = \{w \in C | \forall d : (S)_i^\frown d \textit{ is true in } w\}$ (the set of worlds where S is already true at $(S)_i$, no matter what good final d is concatenated ($^\frown$) to $(S)_i$)
- $\mathbb{F}_i^S = \{w \in C | \forall d : (S)_i^\frown d \textit{ is not true in } w\}$ (the set of worlds where S is already false at $(S)_i$, no matter what good final d is concatenated ($^\frown$) to $(S)_i$)[91]

The novel bit in *Limited Symmetry* is how it connects all this to presuppositions. First some notation:

[89] We use the `verbatim` font to refer to partial syntactic objects.

[90] This way of presenting the constraint differs a little from the approach we took in chapters 2 and 3. However, the difference is only notational and nothing of substance is changing.

[91] As pointed out by an anonymous reviewer, formulating these sets based on true vs non-true opposition (instead of the true vs false opposition) has the advantage of allowing the system to be compatible with an underlying semantics that involves truth value gaps/trivalence. We do not pursue this alternative here (since classical bivalent logic is enough to derive our basic results), but it's an interesting potential extension of the ideas here. See also chapter 3 for an explication of such a system.

(32) **Substitution:** Given a sentence S, $S_{p'p/p}$ is the version of S with all $p'p$ components replaced by p. If S contains no $p'p$ components, then $S_{p'p/p} = S$.

I will make the following assumption: every presuppositional atomic sentence in S is unique. As such $S_{p'p/p}$ contains (at most) only one substitution instance.[92] For example, if $S = (p'p \wedge q)$, then $S_{p'p/p} = (p \wedge q)$.

Now we can state the requirement on $p'p$ constituent of S that we described informally above:

(33) **Presupposition Constraint:** For all sentences S, any i such that $1 \leq i \leq \mathit{length}(S)$, any presuppositional constants $p'p$ in $(S)_i$ (the i-th parsing point of S), it must hold that for all sentences p:

- $\mathbb{T}_i^S \subseteq \mathbb{T}_i^{S_{p'p/p}}$
  - –where $\mathbb{T}_i^S = \{w \in C | \forall d: \ (S)_i^\frown d \text{ is is true in } w\}$
  - –and $\mathbb{T}_i^{S_{p'p/p}} = \{w \in C | \forall d: \ (S_{p'p/p})_i^\frown d \text{ is true in } w\}$
- $\mathbb{F}_i^S \subseteq \mathbb{F}_i^{S_{p'p/p}}$
  - –where $\mathbb{F}_i^S = \{w \in C | \forall d: \ (S_{p'p/p})_i^\frown d \text{ is not true in } w\}$
  - –and $\mathbb{F}_i^{S_{p'p/p}} = \{w \in C | \forall d: \ (S_{p'p/p})_i^\frown d \text{ is not true in } w\}$

The way this works is that given a presuppositional constant $p'p$ in some i-th parsing point of S, one asks two things: **i)** is it the case that for p, the set of worlds where S is **already true** at its i-th parsing point, is a subset of the set of worlds where $S_{p'p/p}$ (the non-presuppositional version of S with p substituting for $p'p$) is **already true** at its corresponding i-th parsing point $(S_{p'p/p})_i$? **ii)** is it the case that for every p, the set of worlds where S is **already false** at its i-th parsing point, is a subset of the set of worlds where $S_{p'p/p}$ (the non-presuppositional version of S with p substituting for $p'p$) is **already false** at its corresponding i-th parsing point $(S_{p'p/p})_i$? If the answer to both

[92] This assumption does not lead to any loss of generality. If a sentence S has multiple instance of $p'p$ in it, rewrite the ones after the first instance with other symbols of the $p'_i p_j$ form, stipulating that the interpretation of these is the same as the original $p'p$, (see also Rothschild 2008).

of these questions is positive, then the update continues to the next parsing point, $i+1$, repeating the above process. If either of the two conditions receives a negative answer, then the update stops (because of presupposition failure).[93]

Examples To make all this more concrete, we briefly illustrate how conjunction works in the system: in a conjunction $S = (p'p \wedge q)$, at parsing step $(S)_3 =$ `(p'p` $\wedge$, the following will obtain:

(34) a. For $(S)_3 =$ `(p'p` $\wedge$:

(i) $\mathbb{T}_3^S = \emptyset$ (we cannot yet reason about worlds where S is already true)

(ii) $\mathbb{F}_3^S = \{w \in C |\ p' = 0 \ \ or \ \ p = 0\}$ (S is already false in worlds here $p'p$ fails)

b. For $S_{p'p/p} = (p \wedge q)$ (the non-presuppositional version of S), at $(S_{p'p/p})_3 =$ `(p` $\wedge$:

(i) $\mathbb{T}_3^{S_{p'p/p}} = \emptyset$

(ii) $\mathbb{F}_3^{S_{p'p/p}} = \{w \in C |\ \ p = 0\}$

c. Checking the presupposition constraint requires that for all p:

(i) $\mathbb{T}_3^S \subseteq \mathbb{T}_3^{S_{p'p/p}}$ (trivial)

(ii) $\mathbb{F}_3^S \overset{?}{\subseteq} \mathbb{F}_3^{S_{p'p/p}}$, i.e., $\{w \in C |\ p' = 0 \ or \ p = 0\} \overset{?}{\subseteq} \{w \in C |\ p = 0\}$

The $\mathbb{T}$ sets are empty in this case, as there is no world where it is guaranteed that no matter what second conjunct completes $(S)_3$, the whole sentence will be true (for any given world, many possible second conjuncts will be false). Accordingly, the subsethood constraint is trivially met with regard to these $\mathbb{T}$ sets. The crucial issue is (c-ii): since subsethood needs to hold for all p, it needs to hold in the case where r is $\top$. Since a tautology is always true, this amounts to:

(35) $\{w \in C |\ p' = 0\} \overset{?}{\subseteq} \emptyset$

[93] Suppose that at some parsing point one can determine that for all p, all of the worlds where the sentence S is already true/false for all continuations, are worlds where $S_{p'p/p}$ is also true/false. Then since these worlds are in the set of true/false worlds for all continuations, when the comprehender moves to next parsing point and recalculates these sets there is no need to include the worlds that they checked on the previous step; for those worlds the constraint holds. So, the comprehender could explicitly remove these worlds from the context as they restart the checking routine. However, encoding this in the definitions above directly would only add to their complexity without any gain/change in the predictions of the theory. Even though we do not pursue this enhancement here, the point is important in the larger scheme of things, as it could help us recover a notion of 'local context' parallel to that of Schlenker 2009.

This will hold just in case $\{w \in C|\ p' = 0\} = \emptyset$ which amounts to $C \models p'$.

Consider now the case of $S = (q \wedge p'p)$, where $q \models p'$. At parsing point $(S)_3 =$ `(q` $\wedge$, we know that S is already False in all worlds where q is False. There is no presupposition to check here, so the constraint is trivially met. The procedure continues: at parsing point `(q`$\wedge$`p'p`, the requirement becomes:

(36) a. For $(S)_4 =$ `(p` $\wedge$ `q'q`, (note that the only good final here is the closing parenthesis):

(i) $\mathbb{T}_4^S = \{w|\ p = 1\ \mathit{and}\ q' = 1\ \mathit{and}\ q = 1\}$

(ii) $\mathbb{F}_4^S = \{w \in C|\ p = 0\ \mathit{or}\ q' = 0\ \mathit{or}\ q = 0\}$

b. For $S_{p'p/p} =$ `(p`$\wedge$`q`:

(i) $\mathbb{T}_4^{S_{p'p/p}} = \{w|\ p = 1\ \mathit{and}\ q = 1\}$

(ii) $\mathbb{F}_4^{S_{p'p/p}} = \{w \in C|\ p = 0\ \mathit{or}\ q' = 0\ \mathit{or}\ q = 0\}$

c. Checking the presupposition constraint requires that for all p:

(i) $\mathbb{T}_4^S \subseteq \mathbb{T}_4^{S_{p'p/p}}$ (trivial)

(ii) $\mathbb{F}_4^S \overset{?}{\subseteq} \mathbb{F}_4^{S_{p'p/p}}$, i.e., $\{w \in C|\ p = 0\ \mathit{or}\ q' = 0\ \mathit{or}\ q = 0\} \overset{?}{\subseteq} \{w \in C|\ p = 0\ \mathit{or}\ q = 0\}$

Reasoning again by taking $q = \top$, we derive that if the constraint holds then it must hold that:

(37) $\{w \in C|\ p = 0\ \mathit{or}\ q' = 0\} \overset{?}{\subseteq} \{w \in C|\ p = 0\}$

This happens just in case all the worlds where $\neg p$ is true are worlds where $\neg q$ is true. Taking the contrapositive of this, we derive that $C \models p \rightarrow q'$. Thus, we derive asymmetric filtering for conjunction.

Crucially, the system predicts symmetry for disjunctions of the form $(p'p\ \vee\ q)$, where $\neg q \models p'$ (i.e. 'bathroom disjunctions', as in (28c)) (see chapters 2 and 3). As we will see in section 5, this will systematically lead to symmetry in disjunctions of questions as well (making different predictions from E's account).

4.4. Limited Symmetry: The inquisitive system

4.4.1. *Limited Symmetry*$_{inq}$

Language and semantics We now 'lift' *Limited Symmetry* to inquisitive semantics and show how it can account for E's data. We return to our language $\mathcal{L}$ that extends $\mathcal{L}^-$ by adding questions:[94]

(38) $\phi := \ p_i \mid p'_j p_k \mid \top \mid \ \bot \ \mid \neg\phi \mid (\phi \wedge \phi) \mid (\phi \vee \psi) \mid \mid (\phi \rightarrow \psi) \mid ?\phi$ (indices are natural numbers and are omitted below)

The semantics of $\mathcal{L}$ are as in (16).

What won't work: Full resolution The core step is to lift the $\mathbb{T}/\mathbb{F}$ concept to this new semantics. Recall that the intuition for the classical system had to do with computing worlds where a sentence was already True/ False. We need to retain this for $\mathcal{L}$ sentences that contain no $?\phi$ formulas, and hence are declaratives. We do this for an inquisitive declarative sentence ϕ by computing the set of states that support $\phi/\neg\phi$ no matter the continuation.

What is the corresponding intuition for polar questions? States in inquisitive semantics formalize the idea of classes of possible worlds where we can resolve a question. So, one starting point would be to try to define sets of states where a question is resolved regardless of possible continuation. On such a conception, $\mathbb{T}$ is the set of a states where a questions has been resolved for every continuation at some parsing point, whereas $\mathbb{F}$ is the set of states where at the current parsing the question has not been resolved. The constraint then can remain the same: we require that for every parsing point i, for every $p'p$, for all p: $\mathbb{T}_S/\mathbb{F}_S \subseteq \mathbb{T}_{S_{p'p/p}}/\mathbb{F}_{S_{p'p}}$.

However, it quickly becomes clear that this is not a tenable analysis.[95] The reason is that this approach doesn't allow us to differentiate between the filtering conditions of $(?p \wedge ?q'q)$ and

[94] As before, the language includes conditionals. We will not make use of conditionals in the examples that we study, and the connective is only included here because the semantics of negation are defined via reference to it. Moreover, in *Limited Symmetry* conditionals are best represented via an $(if\ (\phi)(\psi))$ syntax, so that the parser knows immediately that they are dealing with a conditional, and not just after they have parsed the entirety of the antecedent, see Kalomoiros 2022a for more information.

[95] Thanks to an anonymous reviewer whose comments helped me clarify this point.

$(?\neg p \wedge ?q'q)$.

In both cases, there is a presupposition carried by the second conjunct, with the first conjunct carrying no presupposition. In the first case, we want to derive that the presupposition of the second conjunct is filtered if the first conjunct entails; but in the second case we want derive that the presupposition of the second conjunct is not filtered, even if p entails it, see examples (5b)-(5c).

In both cases, the presupposition constraint will take effect only after the second conjunct has been parsed, as it is just the second conjunct that carries a presupposition. And in both cases the quadripartitive denotation of the two sentences is the same; therefore, these two sentences are resolved in the same sets of states, and not resolved in the same sets of states. Thus, the modified version of *Limited Symmetry* that we considered above, where the equivalent of the $\mathbb{T}$ set is 'states where the issue raised by the sentence is resolved no matter of continuation' and the equivalent of the $\mathbb{F}$ set is 'states where the issue raised by the sentence is not resolved regardless of continuation', will assign exactly the same filtering conditions to both of these sentences. But this is not what we want.

What will work: Drefs and polarity We are going to take the position that the filtering conditions in the case of polar questions are calculated with respect to the discourse referent introduced by such questions. As we will see below, the utility of the discourse referent lies in the fact that it allows comprehenders to calculate whether the resolution of the issue raised by a question is positive or negative: if a state that resolves the issue is also in the denotation of the discourse referent, then the resolution is positive; if on the other hand it's in the denotation of the *negation* of the discourse referent, then the resolution is negative. Here's the idea informally: suppose that you are parsing the conjunctive polar question below:

(39) Is Freedonia located in Europe and is it a nice place?

Once you have access to the 'Is Freedonia located in Europe and' bit, you know that no matter how this continues, all states that support the negation of 'Freedonia is located in Europe' are states where any full resolution of the issue raised by the question is negative. Note that those states do not necessarily resolve the issue raised by the question – to know which of them do that, we need the second conjunct. But for every state that supports the negation of ‘Freedonia is located in Europe’ if that state ends up in the states that resolve the question fully, the resolution will be of **negative polarity** (informally in those states our interlocutor will be able to reply with ‘No’). And we do need access to the second conjunct to know that.

Much like the the world-sorting into true vs not true that inspired the original *Limited Symmetry* system, now comprehenders are sorting states into *states which, if they resolve the question, they resolve it positively for all continuations* vs *states which, if they resolve the question, they resolve it negatively for all continuations.*[96]

The line of reasoning here depends on two crucial parts: **i)** that polar questions introduce discourse referent. **ii)** that these discourse referent are used by comprehenders to calculate the polarity (positive/negative) of a response to a polar question. Let’s justify each of these in turn.

Drefs Let’s start with why one might think that polar questions introduce discourse referents. I will follow Roelofsen & Farkas 2015 in taking the following paradigm to provide a compelling argument for this claim (the paradigm here is adapted from Roelofsen & Farkas 2015, see also Krifka 2001 and Blutner 2012 for relevant discussion):

(40) a. A: Is Emily married?
B: I (don’t) think so.

b. A: Is Emily unmarried?
B: I (don’t) think so.

[96] An alternative here is to assume that comprehenders categorize states into the ones that are in the denotation of the dref (and hence resolve the questions positively) vs ones that are not in the denotation of the dref (and hence are states that either don’t resolve the question, or don’t resolve it positively). In the main text, we will develop the approach whereby states are categorized into being in the denotation of the dref or in the denotation of its negation, as this will allow to straighforwardly derive E’s tripartition pragmatically, (see section 4.2).

c. A: Does Emily speak French ↑ or German ↑?

B: I (don't) think so.

d. A: Does Emily speak French ↑ or German ↓?

B: *I (don't) think so.

Given that 'so' in the responses needs an antecedent, and the obvious antecedent is the declarative underlying the polar questions in (40a)-(40c), we will take it to be the case that polar questions introduce a discourse referent that is predictable from the declarative underlying the question. Note the contrast between(40c) and (40d). The disjunctive question in (40c) is known as 'open', whereas the one is (40d) is known as 'closed'. The contrast between them shows closed disjunctive questions disallow anaphora with 'so'. We put this aside for the moment and come back to it in section 5.

This reasoning receives further support from the following example of a conjunctive polar Q:

(41) A: Is Freedonia located in Europe and is it a nice place?

B: I (?don't) think so.

Without the 'don't' the answer in (41) is clearly interpreted as 'I think that Freedonia is located in Europe and it is a nice place'. This is fully accounted if the declarative underlying the conjunction of polar questions exists a discourse referent and 'so' is anaphoric to that. The answer with 'don't is somewhat more awkward, but again the assumption that the underlying declarative is available for anaphora can help here: replying 'I don't think that Freedonia is located in Europe and it is a nice place' is equivalent to 'I think that either Freedonia is not located Europe or it is not a nice place'. This response then doesn't settle the issue raised by the question in (41) (recall the quadripartition), and hence appears infelicitous.

Polarity Now for the second ingredient, that the discourse referent is used to derive the polarity of the responses. Consider again the following coordination of polar questions:

(42) Is Freedonia located in Europe and is it a nice place?

Recall E's data in (25b)-(25d) about the possible answers to a conjunction of polar questions. The point was that knowing that the proposition underlying the first conjunct is false is enough to make one resolve the question negatively. A way of diagnosing the polarity of a response that a question receives in a state s is to test whether the answer can be prefaced by the polarity particles yes/no. A standard way of understanding 'yes'/'no' responses to a polar question is as agreement (yes) vs disagreement (no) with the discourse referent introduced by the question, (Roelofsen & Farkas 2015, see also Farkas & Bruce 2010 and Pope 1976).[97] For example, consider the following paradigm of responses to (42) in different possible states:

(43) a. Yes (**state:** Freedonia is located in Europe and it is a nice place)

b. No/# Yes (**state:** Freedonia is not located in Europe and it is a nice place)

c. No/# Yes (**state:** Freedonia is located in Europe but it is not a nice place)

d. No/# Yes (**state:** Freedonia is not located in Europe and it is not a nice place)

While one-word yes/no answers are slightly weird, the judgment is clear that in each of the described states, there is one 'correct' yes/no response. This data then suggests that the calculus of polarity for a conjunction of polar questions follows a conjunction-style logic. As long as you

[97] The exact licensing conditions of polarity particles are not an uncomplicated matter (see Roelofsen & Farkas 2015, Farkas & Bruce 2010, Kramer & Rawlins 2009, Pope 1976 a.o. for more details and references). Polarity particles responses to polar question usually come in the form *pol particle + prejacent*, and properties of the prejacent (specifically whether or not the prejacent contains a negation) can affect whether a polarity particle is licensed. Consider the following (taken from Roelofsen & Farkas 2015):

(i) A: Did Peter not call? B: No, he didn't/ Yes, he didn't.

Putting things somewhat loosely here, Roelofsen & Farkas 2015 argue that 'yes' is licensed when the prejacent agrees with the discourse referent introduced by the question (in the sense that the prejacent and the discourse referent express the same proposition) or when the prejacent doesn't contain a negation. 'No' is licensed when the prejacent disagrees with dref or when the prejacent contains a negation. So, in this example, 'yes' is licensed because the response agrees with the content of 'Peter didn't call', but 'no' is also licensed because 'Peter didn't call' contains a negation.

To avoid the confound introduced by whether the prejacent contains a negation, we focus on monolectic yes/no responses which appear to care solely about agreement vs diagreement with the dref introduced by the question.

know that the declarative underlying the first conjunct fails in s (in the sense that s supports the negation of that declarative), then s can be seen as a state where if the question is resolved, it is resolved negatively.[98] From our point of view this is interesting because it means that we can start reasoning about overall polarity for a given state, even if we do not have access to all the parts of the question. For example, at the point `(?p` $\wedge$, we can already isolate states which support the negation of p; hence, if any of these states ends up in the final resolution conditions it will be resolving the question negatively, regardless of what the second conjunct is (i.e., we might not know in which if these states the issue is resolved, but we do know that any potential resolution in these states is negative).[99]

[98]Note that the direction of the logic here: If you can answer 'Yes', or 'No' to a question Q in a given state s, diagnoses polarity in that state; not being able to give a yes/no response in a given state s tells us nothing about the overall polarity in s.

[99]Since the Roelofsen & Farkas 2015 framework has been quite influential to our thinking here, a few comments on it are warranted. Roelofsen & Farkas 2015 also take polar questions to introduce discourse referents. However, they identify the discourse referents with the **positive and negative highlights** of a question $?\phi$ (cf. Roelofsen & Van Gool 2010), which in turn are *possibilities* associated with the meaning of ϕ. Possibilities/Alternatives are the maximal states in the denotation of ϕ. Therefore, the drefs that Roelofsen & Farkas 2015 use do not have syntactic status, but rather are semantic in nature. For our purposes, it will be more convenient to have access to a syntactic dref so that we can reason about its possible continuations during the parse.

Another aspect of the Roelofsen & Farkas 2015 system is that the discourse referents are marked as positive vs negative. This is needed because they want to account for the distribution of polarity particles like 'yes' and 'no', which are sensitive to whether the discourse referent introduced by the question contains a negation or not (see fn 97). Since the notion of 'resolving/not resolving a question positively' that is of interest to us cares only about agreement with the discourse referent, and not about the presence/absence of negation, we eschew the more complicated definition of highlights in the interest of keeping things simple.

That said, even if one wanted to use the definitions of highlights to define the relevant notions, there is at least one non-trivial challenge to be overcome. To see this, first consider the definition of highlights:

(i)
- $[\![p]\!]^{+/-} = \langle \{|p|\}, \emptyset \rangle$
- $[\![\neg\phi]\!]^{+/-} = \langle\, \emptyset, \{\overline{\cup[\![\phi]\!]^{+/-}}\} \rangle$
- $[\![\phi \vee \psi]\!]^{+/-} = \langle [\![\phi]\!]^{+} \cup [\![\psi]\!]^{+}, [\![\phi]\!]^{-} \cup [\![\psi]\!]^{-} \rangle$
- $[\![?\phi]\!]^{+/-} = \begin{cases} \langle\, \emptyset, \{\alpha\} \rangle \text{ if } [\![\phi]\!]^{+/-} = \langle\, \emptyset, \{\alpha\} \rangle \\ \langle \{\cup[\![\phi]\!]^{+/-}\}, \emptyset \rangle \text{ otherwise} \end{cases}$

The first coordinate of these pairs represents the positive highlight, whereas as the second coordinate represents the negative highlight. If we wanted to extend this to conjunction, the obvious clause to add would be:

(ii) $[\![\phi \wedge \psi]\!]^{+/-} = \langle [\![\phi]\!]^{+} \cap [\![\psi]\!]^{+}, [\![\phi]\!]^{-} \cap [\![\psi]\!]^{-} \rangle$

This predicts for instance that the highlight introduced by $(?p \wedge ?q)$ is positive and can be identified with $\{|p \wedge q|\}$. As we saw this is the proposition that 'so' picks up in an example like (41). However, consider the following:

(iii) A: Is Emily unmarried and does she like traveling? B: I think so.

The 'so' here picks up 'Emily is unmarried and likes traveling' as its referent. But our extension does not predict this. If we represent (iii) as $(?\neg p \wedge ?q)$, then $[\![?\neg p]\!]^{+/-} = \langle \emptyset, \{|p|\} \rangle$, and $[\![?q]\!]^{+/-} = \langle \{|q|\}, \emptyset \rangle$. Taking the point-wise intersection, we get $[\![?\neg p \wedge ?q]\!]^{+/-} = \langle \emptyset, \emptyset \rangle$. This means that no non-empty possibility is available to be picked up by

Formalization Our proposal is to make *Limited Symmetry* sensitive to the online polarity calculation analyzed above, and derive the projection facts in this way.

The intuition formulated above was that given a polar question ϕ, at parsing point $(\phi)_i$ try and see if you can isolate states that are positive or negative with respect to the potential resolution of the question, regardless of continuation. To do this, one needs access to the discourse referent introduced by the question. We will take this to be equivalent to the declaratives underlying the question, i.e. to the version of S where all the question operators have been removed. Let's denote this version as $Decl(S)$, and define it inductively as follows:

(44) For any $\mathcal{L}^+$ sentence ϕ:

(i) If $\phi := p$, then $Decl(\phi) = p$

(ii) If $\phi := p'p$, then $Decl(\phi) = p'p$

(iii) If $\phi := \top$, then $Decl(\phi) = \top$

(iv) If $\phi := \bot$, then $Decl(\phi) = \bot$

(v)If $\phi :=?\psi$, then $Decl(\phi) = Decl(\psi)$

(vi) If $\phi := \psi \wedge \chi$, then $Decl(\phi) = Decl(\psi) \wedge Decl(\chi)$

(vii) If $\phi := \psi \vee \chi$, then $Decl(\phi) = Decl(\psi) \vee Decl(\chi)$

Now given a context C and sentence S, the corresponding sets for $\mathbb{T}$ and $\mathbb{F}$ can be defined as follows:

(45) a. $\mathbb{P}(os)$: $\{s \subseteq C |\ \forall d: \ s \vdash Decl(\ (S)_i^\frown d\ )\}$

b. $\mathbb{N}(eg)$: $\{s \subseteq C |\ \forall d: \ s \vdash \neg Decl(\ (S)_i^\frown d\ )\}$[100]

The inquisitive version of *Limited Symmetry* then is that as you are parsing a question from left to

'so'. While there may some way to get correct results here, taking the discourse referent to be syntactic simplifies the situation considerably and avoids such complications.

[100]Note that as in section 3, fn 91, the definition here is not necessarily tied to truth vs falsity of $Decl(S)$. One could perfectly well define $\mathbb{N}$ to be the set of states that support the non-truth of $Decl(S)$, where non-truth could be falsity or undefinedness in a trivalent system. As with the classical *Limited Symmetry* system we do not pursue such an alternative here (but see chapter 3).

right, you try to determine at every parsing point in what sets of worlds (states) of the context any answer to the question will be of positive vs negative polarity, regardless of continuation. Note that these states are not states where the question is necessarily resolved; rather they are states which if they end up resolving the question, the resolution will be of positive/negative polarity. The point is that such 'overall polarity' calculations can happen even if the parser doesn't have access to the whole question.

The claim is then that presuppositions matter when making these online polarity calculations. So, a 'lifted' version of our presupposition constraint can be stated:[101]

(46) **Presupposition Constraint:** For all contexts C, sentences S, any i such that $1 \leq i \leq length(S)$, any presuppositional constants $p'p$ in $(S)_i$ (the i-th parsing point of S), it must hold that for all p:

- $\mathbb{P}_i^S \subseteq \mathbb{P}_i^{S_{p'p/p}}$
  –where $\mathbb{P}_i^S = \{s \subseteq C |\ \forall d :\ s \vdash Decl(\ (S)_i^\frown d\ )\}$
  –and $\mathbb{P}_i^{S_{p'p/p}} = \{s \subseteq C |\ \forall d :\ s \vdash Decl(\ (S_{p'p/p})_i^\frown d\ )\}$
- $\mathbb{N}_i^S \subseteq \mathbb{N}_i^{S_{p'p/p}}$
  –where $\mathbb{N}_i^S = \{s \subseteq C |\ \forall d :\ s \vdash \neg Decl(\ (S)_i^\frown d\ )\}$
  –and $\mathbb{N}_i^{S_{p'p/p}} = \{s \subseteq C |\ \forall d :\ s \vdash \neg Decl(\ (S_{p'p/p})_i^\frown d\ )\}$[102]

Note how everything presupposition-related happens at the level of incrementally computing polarity. The semantics has remained entirely classical, with no asymmetries encoded in it. In what follows, I will often not make explicit reference to the context C to avoid clutter; however, as is clear from the definitions above the constraint is always computed against such a context. We now turn to applying *Limited Symmetry*$_{inq}$ to E's data.

[101] For the constraint in (46) to be fully defined one needs to extend the definition $S_{p'p/p}$ to L^+. Since the extension is routine, we leave it implicit.

[102] As the definitions make clear, the constraint is checked against a contextually restricted set of worlds C. The examples below often drop reference to C to avoid cluttering, but it's always assumed to be present in the background.

4.4.2. Conjoined polar questions

(?p′p ∧ ?q) Consider first $S = (?p'p \wedge ?q)$. The first parsing point where we can start reasoning about the overall polarity of possible responses is $(S)_4 =$ `(?p'p` $\wedge$, when we know that we are dealing with a conjunction.[103] To check the presupposition constraint, we must first reason about states which for all d support either $Decl($ $(?p'p\wedge \frown d$ $)$ (positive) or $\neg Decl($ $(?p'p\wedge \frown d$ $)$ (negative). Since, $Decl$ removes ?-operators, this means finding states that support either $(p'p\wedge \frown d$ or $\neg(p'p\wedge \frown d$, for any good-final d that contains no ?-operators:

(47) For $(S)_4 =$ `(?p'p` $\wedge$:

a. $\mathbb{P}_4^S = \{\emptyset\}$ (only the empty set of worlds is such that every world in it makes $|(p'p\wedge d|$ true for any d)[104]

b. $\mathbb{N}_4^S = \{s|\ s \vdash \neg p\ or\ s \vdash \neg p'\}$ (any state that supports the negation of $p'p$ supports the negation of $(p'p \wedge d$ for any d)

We also need access to the corresponding sets for $(?p'p \wedge ?q)_{p'p/p} = (?p \wedge ?q)$ (the version of the sentences with the presuppositions removed), at the corresponding parsing point $(S_{p'p/p})_4 =$ `(?p` $\wedge$:

(48) For $(S_{p'p/p})_4 =$ `(?p` $\wedge$:

a. $\mathbb{P}_4^{S_{p'p/p}} = \{\emptyset\}$

b. $\mathbb{N}_4^{S_{p'p/p}} = \{s|\ s \vdash \neg p\}$

We can now check the presupposition constraint, which requires that for all p:

(49) a. $\mathbb{P}_4^S \subseteq \mathbb{P}_4^{S_{p'p/p}}$

b. $\mathbb{N}_4^S \subseteq \mathbb{N}_4^{S_{p'p/p}}$

[103]We count ?-operators as a basic parsing unit.

[104]Recall that $|\phi|$ is the classical proposition associated with inquisitive ϕ.

It is obvious that $\mathbb{P}_4^S \subseteq \mathbb{P}_4^{S_{p'p/p}}$. For the $\mathbb{N}$ sets we reason as follows: take $p = \top$; Then, $\{s|\ s \vdash \neg\top\} = \{\emptyset\}$, so we can rewrite the $\mathbb{N}$ sets as:

(50) a. $\mathbb{N}_4^S = \{s|\ s \vdash \neg p'\} \cup \{\emptyset\} = \{s|\ s \vdash \neg p'\}$

b. b. $\mathbb{N}_4^{S_{p'p/p}} = \{\emptyset\}$

Recall that the empty state is already a member of $\{s|\ s \vdash \neg p'\}$. Hence $\mathbb{N}_4^S = \{s|\ s \vdash \neg p'\}$. So, for $\mathbb{N}_4^S$ to be a subset of $\mathbb{N}_4^{S_{p'p/p}}$ it needs to hold that $\{s|\ s \vdash \neg p'\} = \{\emptyset\}$. This can only happen if there are no subsets of the contexts where $\neg p'$ is supported, i.e if $C \models p'$. Hence, the sentence is associated with a presupposition, which must be entailed by the context to make the constraint hold (just like the declarative case).

$(?\mathbf{q} \wedge ?\mathbf{p'p})$ Consider now $S = (?q \wedge ?p'p)$. Both $(S)_4$ and $(S_{p'p/p})_4 =$ `(?q` $\wedge$, so the subsethood constraint will hold here as $\mathbb{P}$ and $\mathbb{N}$ will not differ between S and $S_{p'p/p}$. The parse then moves on to $(S)_6 =$ `(?q` $\wedge$ `?p'p`; now we can reason about states where the question receives both a positive and a negative polarity response:

(51) For $(S)_6 =$ `(?q` $\wedge$ `?p'p`:

a. $\mathbb{P}_6^S = \{s|s \vdash q \textit{ and } s \vdash p \textit{ and } s \vdash p'\}$

b. $\mathbb{N}_6^{S_{p'p/p}} = \{s|\ s \vdash \neg q \textit{ or } s \vdash \neg p'p\}$

(52) For $(S_{p'p/p})_6 =$ `(?q` $\wedge$ `?p`:

a. $\mathbb{P}_6^{S_{p'p/p}} = \{s|\ s \vdash q \textit{ and } s \vdash p\}$

b. $\mathbb{N}_6^{S_{p'p/p}} = \{s|\ s \vdash \neg q \textit{ or } s \vdash \neg p\}$

(53) For all p, we require:

a. $\mathbb{P}_6^S \subseteq \mathbb{P}_6^{S_{p'p/p}}$

b. $\mathbb{N}_6^S \subseteq \mathbb{N}_6^{S_{p'p/p}}$

The subsethood between $\mathbb{P}_6^S$ and $\mathbb{P}_6^{S_{p'p/p}}$ is clear. For the $\mathbb{N}$ sets we reason as follows. The subsethood in (53b) holds iff $|q| \models |p'|$. To see this, suppose first that (53b) holds for all p. Then it must hold for $p = \top$. Then we have:

(54) $\{s|\ s \vdash \neg q \textit{ or } s \vdash \neg p'\top\} \subseteq \{s|\ s \vdash \neg q \textit{ or } s \vdash \neg\top\}$

Only the empty state supports $\neg\top$. Hence we have:

(55) $\{s|\ s \vdash \neg q \textit{ or } s \vdash \neg p'\top\} \subseteq \{s|\ s \vdash \neg q\} \cup \{\emptyset\}$

Note that all the state that support $\neg q$ are in both sets. So, the requirement boils down to:

(56) $\{s|\ s \vdash \neg p'\top\} \subseteq \{s|\ s \vdash \neg q\}$

A state supports $\neg p'\top$ just in case no worlds in it make $|p'|$ true. For every world w in the context that makes $|\neg p'|$ true, $\{w\}$ is in $\{s|\ s \vdash \neg p'\top\}$. Since we are assuming that (56) holds, then $\{w\}$ is also in $\{s|\ s \vdash \neg q\}$, which means that $|\neg q|$ is true in w. So, all worlds that make $|\neg p'|$ true also make $|\neg q|$ true, which means that $|q| \models |p'|$.

For the other direction, suppose that $|q| \models |p'|$ and consider the subsethood we want show holds:

(57) $\{s|\ s \vdash \neg q \textit{ or } s \vdash \neg p'p\} \subseteq \{s|\ s \vdash \neg q \textit{ or } s \vdash \neg p\}$

Clearly, all the states that support $\neg q$ are in both sets. The question is if states that support q and $\neg p'p$ (which are in the left set) are also in the right set. Since they support q, they must also support p' (by assumption). Therefore, they must support $\neg p$ (otherwise they wouldn't support

$\neg p'p$), and hence must also be in the right set.

So, we have just derived that conjunctions of polar questions behave asymmetrically modulo presupposition projection while keeping the underlying semantics of polar questions fully symmetric and bivalent!

Finally, note how the parsing-oriented reasoning can **recover** E's tripartition at the pragmatic level: at parsing point $(S)_4 =$ `(?q` $\wedge$ we know that the question receives a negative polarity answer in $\{s|\ s \vdash \neg q\}$. These states are in $\mathbb{N}$ for both S and $S_{p'p/p}$ no matter the continuation. Therefore, they can be ignored in subsequent calculations (see also fn 93). In fact, we could assume that comprehenders remove them from consideration when going to compute further $\mathbb{P}$ and $\mathbb{N}$ sets. Then, $(S)_6 =$ `(?q` $\wedge$ `?p'p` we calculate $\{s|s \vdash q\ \mathit{and}\ s \vdash p\ \mathit{and}\ s \vdash p'\}$ as determining a positive polarity answer; finally, we calculate $\{s|\ s \vdash q\ \mathit{and}\ s \vdash \neg p'p\}$ as determining a negative polarity answer. If for each one of these sets we consider its maximal subset, then we get alternatives corresponding to $\{\neg q,\ q \wedge p'p,\ q \wedge \neg p'p\}$, which is exactly E's tripartition.

4.4.3. Negative polar questions

Consider now the issue of negative polar questions:

(58) #Is Emily unmarried and is her spouse a doctor? $\rightsquigarrow$ $(?(\neg q) \wedge ?p'p)$, $|q| \models |p'|$.

At parsing point $(S)_7 =$ `(?(¬q)` $\wedge$, we can determine a $\mathbb{N} = \{s|\ s \vdash q\}$, where the question receives a negative polarity response regardless of continuation. We move on to $(S)_9 =$ `(?(¬q)` $\wedge$ `?p'p`:

(59) a. $\mathbb{P}_9^S = \{s|s \vdash \neg q\ \mathit{and}\ s \vdash p\ \mathit{and}\ s \vdash p'\}$

b. $\mathbb{N}_9^S = \{s|\ s \vdash q\ \mathit{or}\ s \vdash \neg p'p\}$

(60) For $(S_{p'p/p})_9 =$ `(?(¬q)` $\wedge$ `?p`:

a. $\mathbb{P}_9^{S_{p'p/p}} = \{s|\ s \vdash \neg q\ \mathit{and}\ s \vdash p\}$

b. $\mathbb{N}_9^{S_{p'p/p}} = \{s|\ s \vdash q\ or\ s \vdash \neg p\}$

For all p substituting for p, $\mathbb{P}_9^S \subseteq \mathbb{P}_9^{S_{p'p/p}}$. But consider the $\mathbb{N}$ sets:

(61) a. $\mathbb{N}_9^S = \{s|\ s \vdash q\ or\ s \vdash \neg p'p\}$

b. $\mathbb{N}_9^{S_{p'p/p}} = \{s|\ s \vdash q\ or\ s \vdash \neg p\}$

When does it hold that for all p, $\mathbb{N}_9^S \subseteq \mathbb{N}_9^{S_{p'p/p}}$? Following reasoning parallel to that we used in the previous subsection for $(?q \wedge ?p'p)$, we derive that it holds iff $|\neg q| \models |p'|$.

In (58) it holds that $|q| \models |p'|$. But the constraint says that it must also hold that $|\neg q| \models |p'|$. This means that $|p'|$ must hold in every world in the context. We thus derive that (58) comes with a global presuppositional requirement (which makes it different from (5b) that comes with no such requirement) Therefore, in the absence of the right context/out of the blue, the infelicity that (58) shows is expected.

In this way, the asymmetry between positive and negative polar questions in conjunction that E points out falls out in our system. More broadly, the point is that even though $?p$ and $?(\neg p)$ receive the same inquisitive denotation, they are mapped to different $\mathbb{P}/\mathbb{N}$ sets: $\mathbb{P}^{?p} = \{s|s \vdash p\}$, but $\mathbb{P}^{?(\neg p)} = \{s|s \vdash \neg p\}$ (and the reverse for the $\mathbb{N}$ sets).

4.4.4. 'or not' questions

The final conjunction-related piece of data that we need to account for is the case of 'or not' questions:

(62) #Is Emily married or not, and is her spouse a doctor?

The first conjunct could receive an analysis either as $(?p \vee ?(\neg p))$ or $?(p \ \vee \ (\neg p))$, depending on what we take 'or not' to elide (a full question or just a declarative). E assumes the former analysis.

However, the issue is orthogonal to our purposes, as either analysis leads to the same conclusion; the reason is that $Decl(?(p \;\vee\; q)) = Decl((?p \vee ?q)) = (p \vee q)$.

On the $(?p \;\vee\; ?(\neg p))$ analysis, the sentence is $S = ((?p \;\vee\; ?(\neg p)) \;\;\wedge\;\; q'q)$, with $|p| \models |q'|$; at parsing point $(S)_{12} = \texttt{((?p} \vee \texttt{?(}\neg\texttt{p))} \wedge$, we know that we are dealing with a conjunction. Hence we can try to calculate a $\mathbb{N}$, which will be the set of states that support the negation of the declarative underlying the first conjunct:

(63) $\quad \mathbb{N}^{S}_{12} = \{s|\ s \vdash \neg p \textit{ and } s \vdash p\} = \{\emptyset\}$

What (63) says is that only the empty state fixes the polarity to an answer of this question as negative, at this point in the parse. The first conjunct carries no presuppositions, so the presupposition constraint is met. We parse the rest, and get access to $(S)_{13} = \texttt{((?p} \vee \texttt{?(}\neg\texttt{p))} \wedge \texttt{q'q}$. Reasoning about the $\mathbb{N}$ is enough to show that (62) is associated with a presupposition:

(64) a. $(S)_{13} = \texttt{((?p} \vee \texttt{?(}\neg\texttt{p))} \wedge \texttt{q'q}$:

b. $\mathbb{N}^{S}_{13} = \{s|\ (s \vdash \neg(p \vee \neg p) \textit{ or } (s \vdash \neg q'q)\}$

Note that $\{s|\ s \vdash \neg(p \vee \neg p)\} = \{\emptyset\}$, thus:

(65) $\quad \mathbb{N}^{S}_{13} = \{\emptyset\} \cup \{s|\ s \vdash \neg q'q\} = \{s|\ s \vdash \neg q'q\}$

For $S_{p'p}$, the corresponding $\mathbb{N}$ at $(S_{p'p/p})_{13} = \texttt{((?p} \vee \texttt{?(}\neg\texttt{p))} \;\wedge \texttt{q}$ is:

(66) $\quad \mathbb{N}^{S_{p'p/p}}_{13} = \{s|\ s \vdash \neg q\}$

Since now there is a presuppositonal bit, we need to check whether the constraint is met:

(67) For all q: $\mathbb{N}_{13}^{S} \overset{?}{\subseteq} \mathbb{N}_{13}^{S_{p'p/p}}$

There is nothing to guarantee here that $\{s|\ s \vdash \neg q'\}$ contains only the empty state (which would be needed to guarantee subsethood for all q); instead we need the context to entail q'. Thus, (62) is predicted to be associated with a presupposition (and hence infelicitous unless the context satisfies that presupposition) (essentially the same explanation E gives, but derived from the general principles of *Limited Symmetry*).

4.4.5. Interim summary

Summing up, we have shown how *Limited Symmetry* can be naturally extended to an inquisitive version, capturing the asymmetry of filtering in conjunctions of polar questions: presuppositions in the second conjunct of a conjoined polar question can be filtered if entailed by the (declarative underlying) the first conjunct; presuppositions in the first conjunct of a conjoined polar questions must be entailed by the global context. At the same time, we have shown how negative polar questions, $?(\neg p)$ and 'or not' questions, $?p \vee ?(\neg p)$, do not behave equivalently to their positive counterpart, $?p$, in terms of presupposition filtering, even though they have the same inquisitive denotations: whereas $?p$ as a first conjunct can lead to filtering of a presupposition of $?q$ in $(?p \wedge ?q)$, this is not so for $?(\neg p)$ and $(?p \vee ?(\neg p))$; instead, both $(?(\neg p) \wedge ?q)$ and $((?p \vee ?(\neg p)) \wedge ?q)$ need the presuppositions of q to be established in the context, otherwise they are infelicitous. So, we have derived all of E's conjunction data within the inquisitive extension of *Limited Symmetry*, without baking any asymmetries in the semantics. We now turn to our final topic: the system's predictions for disjunctions.

4.5. Disjoined polar questions

The data E points out that the phenomenon of projection in coordinations of polar questions extends to disjunctions; he gives a judgment whereby projection from disjunctions follows the same pattern as projection form conjunction (see also fn 78):

(68) a. **Context:** We have no idea whether or not Emily is married, but whenever we see her,

she's alone.

b. Is Emily unmarried or is her spouse away?

c. ??Is Emily's spouse away or is she unmarried?

The judgment for (68b) is uncontroversial and parallels the judgment for the declarative version of such disjunctions, where a presupposition in the second disjunct is filtered if the negation of the first disjunct entails that presupposition (Karttunen, 1973). However, as it has been discussed extensively in the literature on projection, disjunctions appear symmetric: it doesn't matter whether or not it is the first or second disjunct whose negation entails the presuppositions of the other disjunct; both cases in (69) appear fine (Hausser 1976; Soames 1982; cf. Partee's 'Bathroom sentences', see also Schlenker 2009):

(69) a. **Context:** We have no idea whether or not the house we are in has a bathroom, but we can't seem to find one.

b. ✓Either there is no bathroom or the bathroom is in a weird place.

c. ✓Either the bathroom is in a weird place or there is no bathroom.

In this respect, declarative disjunctions differ from conjunctions modulo their projection properties, with this conclusion receiving experimental support in chapter 2. To the extent that we are dealing with parallel phenomena, we would expect this difference to carry over to disjunctions of polar questions; nevertheless, E reports an asymmetry in judging (68c) infelicitous, and builds this asymmetry in his trivalent semantics for disjunction (although he acknowledges the complexity of the issue, and points out that one could move to a Strong Kleene truth table that would give symmetric disjunction).[105] The results of our own informal survey of native speakers suggest no

[105] Of course the issue here is the justification. The Strong Kleene truth table for conjunction is also symmetric, but experimental results suggest that projection is rigidly asymmetric in conjunction (Mandelkern et al. 2020). This is exactly the justification that *Limited Symmetry* aims to provide by deriving symmetric disjunction, but asymmetric conjunction. That said, there are ways to systematically derive trivalent truth tables where conjunction is asymmetric but disjunction symmetric. George 2008b proposes the so-called 'disappointment' algorithm which derives a symmetric trivalent truth table for disjunction, but an asymmetric one for conjunction. One could state E's resolution conditions in terms of this system and thus get the right (a-)symmetries in a principled way. Thanks to Patrick Elliot

difference between (68b) and (68c) (although more fine-grained experimental data of the kind found in Kalomoiros & Schwarz (Forth) would be needed to bolster this point). So for the purposes of this chapter, we proceed on the assumption that disjunction indeed behaves symmetrically.

Varieties of disjunctive polar Qs Our aim is to spell out the predictions of our system for disjunction. A complicating factor is that disjunctive polar questions come in two sorts: *open* and *closed* (Roelofsen & Farkas 2015):

(70) a. Does Mary like cats$^{\uparrow}$ or does she like dogs$^{\uparrow}$? (Open)

b. Does Mary like cats$^{\uparrow}$ or does she like dogs$^{\downarrow}$? (Closed)

Open disjunctive questions have rising intonation on both disjuncts. The issue they raise can be resolved by affirming the first disjunct, the second disjunct, or the negation of both disjuncts: Mary likes cats, Mary likes dogs, Mary likes neither. Closed disjunctive questions on the other hand, have rising intonation on the first disjunct, but falling intonation on the second; they are taken to presuppose *exhaustiveness* (i.e. that Mary liking cats or dogs are the only two possibilities in the context), and *exclusivity* (i.e. that Mary doesn't like both cats and dogs). Since E argues that the presupposition facts do not vary across these two types, we apply our system to both of them.

Open Let's start with the open disjunctions. While the syntax of (68) might suggest a translation like $(?p \vee ?q)$, it has been argued that this gives the wrong resolution conditions (Hoeks & Roelofsen 2020). $(?p \vee ?q)$ suggests that being (for instance) in a state that supports that 'Mary doesn't like cats' would be enough to resolve the issue raised by (70a); as Hoeks & Roelofsen 2020 point out that this doesn't seem correct; instead they contend that the correct resolution conditions are given by $?(p \ \vee \ q)$: the issue is resolved by states that support p, states that support q and states that support neither p nor q. However, this debate is orthogonal with regards to our approach, since $Decl((?p \vee ?q)) = Decl(?(p \vee q)) = Decl((p \vee q)) = (p \vee q)$. In all cases, a prediction of symmetric filtering is made (as long the negation of the non-presuppositional disjunct entails the presuppositions of the other disjunct). We illustrate with $S = (?p'p \vee ?q)$:

(pc) for discussion on this point.

(71) At $(S)_4 =$ `(?p'p` $\vee$, $\mathbb{P}$ look at follows:

a. $\mathbb{P}_4^S = \{s|\ s \vdash p\ and\ s \vdash p'\}$

b. $\mathbb{P}_4^{S_{p'p/p}} = \{s|\ s \vdash p\}$

Since for all p, $\mathbb{P}_4^S \subseteq \mathbb{P}_4^{S_{p'p/p}}$, our presupposition constraint holds.

(72) At $(S)_4 =$ `(?p'p` $\vee$, $\mathbb{N}$ look as follows:

a. $\mathbb{N}_4^S = \mathbb{N}_4^{S_{p'p/p}} = \{\emptyset\}$ (only the empty state supports $\neg(p'p \vee d$, for any good final d)

Moving on with the parse, we have:

(73) At $(S)_5 =$ `(?p'p` $\vee$ `?q`

a. $\mathbb{P}_5^S = \{s|\ s \vdash p'p\ or\ s \vdash q\}$

b. $\mathbb{P}_5^{S_{p'p/p}} = \{s|\ s \vdash p\ or\ s \vdash q\}$

Clearly, for all p, $\mathbb{P}_5^S \subseteq \mathbb{P}_5^{S_{p'p/p}}$; hence, no violation of the constraint. Let's move on to the $\mathbb{N}$ sets:

(74) At $(S)_5 =$ `(?p'p` $\vee$ `?q`:

a. $\mathbb{N}_5^S = \{s|\ s \vdash \neg p'p\ and\ s \vdash \neg q\}$

b. $\mathbb{N}_5^{S_{p'p/p}} = \{s|\ s \vdash \neg p\ and\ s \vdash \neg q\}$

The required subsethood is, for all p:

(75) $\{s|\ s \vdash \neg p'p\ and\ s \vdash \neg q\} \subseteq \{s|\ s \vdash \neg p\ and\ s \vdash \neg q\}$

Suppose that this holds. Then it holds for $p = \top$, in which case we we have:

(76) $\{s|\ s \vdash \neg p'\top\ \mathit{and}\ s \vdash \neg q\} \subseteq \{s|\ s \vdash \neg\top\ \mathit{and}\ s \vdash \neg q\}$

The latter is equivalent to:

(77) $\{s|\ s \vdash \neg p'\ \mathit{and}\ s \vdash \neg q\} \subseteq \{\emptyset\}$

This holds iff there are no worlds in C such that $|\neg p'|$ is true and $|\neg q|$ is true; so, all worlds should be worlds that make $|p' \vee q|$ true, which can be rewritten as $C \models |\neg q| \rightarrow |p'|$. For the other direction, it's easy to see that if $C \models |\neg q| \rightarrow |p'|$, then (75) holds.

Very similar reasoning derives the same result for a disjunction like $(?q \vee ?p'p)$.

Closed Regarding closed disjunctive questions, Hoeks & Roelofsen 2020 analyse them as $(p \vee q)$ in an inquisitive framework; E analyses them as a species of $(?p \vee ?q)$, where an positivity operator applies and gets rid of the negative answers. Either way, since $Decl(p \vee q) = Decl((?p \vee ?q))$ the calculation for open disjunctions above works in exactly the same way, predicting symmetry.[106]

Back to Drefs The reasoning around the disjunction cases depends on having the *Decl* dref available. However, recall the following paradigm:

(78) a. A: Does Emily speak French ↑ or German ↑?
B: I (don't) think so.

b. A: Does Emily speak French ↑ or German ↓?
B: *I (don't) think so.

The dref seems available in the case of open disjunctive polar questions, but not in the case of closed ones. However, recall that closed disjunctive questions come with presuppositions of exhaustiveness

[106] I take no position here on the correct analysis for closed disjunctive questions, as it is beyond the scope of the projection facts.

and exclusivity. If we assume that dref inherits these, then the unacceptability of (78b) will fall out.

If one replies 'I think so' to the question in (78b), then they are affirming that they think it's the case that Mary speaks French or German, when it's already presupposed that these are the only two possibilities in the context (exhaustiveness). So, the response is trivial.

If on the other hand one replies 'I don't think so', they are saying that they don't think it's the case that Mary speaks French or German, i.e. they think Mary speaks neither French nor German. But again by exhaustiveness, one of the two options is the case, so this response leads to a contradiction.

Therefore, the contrast in (78) is perfectly intelligible even under the assumption that closed disjunctive questions introduce a dref.

4.6. Discussion: Trade offs

We could see the problem posed by the challenge identified by E in terms of the following opposition:[107]

(79)
- Questions denote resolution conditions which are symmetric
- The filtering behavior of a connective should fall out of the semantics of the connective plus the semantics of the expressions it connects.

E shows that these two statements are not compatible, and chooses to resolve the issue by dropping the assumption of symmetric resolution conditions of polar question; in his system, polar questions are asymmetric in the semantics, where positive resolutions are mapped to 1, negative to 0, and other states to #. This 'semanticization' of kinds of resolution allows for the usual Middle Kleene definition of conjunction/disjunction to be used without change, managing to preserve the second bullet point above.

Like E's approach, our approach is similar in that it postulated that polar questions introduce

[107]Thanks to an anonymous reviewer for suggesting this way of looking at the issues.

a positive/negative dichotomy. But this dichotomy was put into the pragmatics, thus allowing the resolution conditions of polar questions to remain symmetric in the semantics. However, in doing so we had to take the filtering properties of questions to be derived from the declarative that underlies them. In this way, we drop the assumption that when we are computing the filtering conditions of a polar question, we are making reference only to the resolution conditions of that question. As noted by an anonymous reviewer, there is a conceptual limitation to dropping the second bullet point, in the sense that some filtering properties are derived directly from the semantics of an expression while others are derived indirectly, after some 'transformation' has been applied to that expression (in the present case the 'transformation' consists in recovering the declarative).[108] One can then ask the question if there is something that predicts when to go or not to go for a 'transformation' in recovering the filtering properties of some expression, or whether this simply needs to be stipulated.

Here, I grounded the abandonment of the second bullet point in the case of questions on two things: first, putting the asymmetry in the semantics leads to problematic empirical predictions with respect to what answers resolve a conjunctive polar question (section 2.5); second, a desire to have parallel (Stalnaker-inspired) mechanisms apply to both declaratives and questions.

As regards the issue of predicting when a 'transformation' is needed, the present approach doesn't suggest an algorithm for predicting this, but it does suggest a reduction of the problem to the problem of when something introduces a discourse referent. The idea is that if certain complex expressions introduce (simpler) discourse referents, then filtering properties in those cases are derived on the basis of the dref. The problem then becomes predicting when a dref is introduced. Some support for this way of thinking comes from the fact that the filtering patterns we examined in this chapter are in fact an instance of a more general problem: the problem of filtering in modal subordination environments, (van Rooij, 2005). Consider the following paradigm:

[108] The same reviewer also points out that once we move away from the semantics of the question to essentially the semantics of the declarative, one could have applied a theory like Transparency to $Decl(?\phi)$ and get good results. We chose *Limited Symmetry* as it offered an interesting hypothesis about what comprehenders go about computing incrementally when parsing polar questions and their conjunctions/disjunctions, and also made interesting predictions about (a-)symmetries between conjunction vs disjunction.

(80) a. #It's possible that John stopped smoking.

b. #It's possible that John stopped smoking and it's possible he was a smoker.

c. ✓It's possible that John was a smoker and it's possible that he stopped smoking.

The pattern here is conceptually the same as the one we encountered with polar questions: a sentence S is embedded under an operator (question operator, modal etc.); in simple cases like (80a) the presuppositions of S project. Embedded in a conjunction, the presuppositions of S project, (80b), unless they are entailed not be the first conjunct, but by the operator-free version of the first conjunct, (80c).

So, again, we are faced with an asymmetry in conjunction, and we can replay the debate of whether it should be put in the semantics or derived pragmatically. From our point of view, It's interesting that modal subordination has been analysed as a construction where discourse referents are introduced (Roberts, 1989), some of which have been argued to be propositional in nature (Kibble, 1994; Geurts, 1995).[109] One could try then to solve the filtering problem by making reference to the drefs introduced, or try to revise the semantics of modals to encode the relevant asymmetries.[110]

In view of the generality of the patterns though, a potential conceptual advantage of the dref approach (apart from the empirical advantages we discussed for the case of questions) would be that there is some syntactic 'glue' unifying the constructions where filtering seems to care about the part of the sentence that is below some operator. This would justify why they behave like a natural class. On the approach where these effects are semanticized, the generality appears accidental,

[109]For example:

(i) It's possible that Mary speaks French, but I don't think that's the case.

The 'that' in the second conjunct refers to 'Mary speaks French'.

[110]van Rooij 2005 proposes a dynamic solution that eschews discourse referents, but the asymmetry is essentially introduced by the update effect that modals have. Simplifying quite a bit, updating with a sentence like 'It's possible that John used to smoke' makes the worlds where 'John used to smoke' preferred. In a conjunction then like (80c), the second conjunct is sensitive to these 'preferred' worlds. van Rooij 2005 solution is stated in a dynamic framework where what is presupposed is analysed as a propositional attitude. The differences between his system and the systems we have been discussing in the present chapter are sufficiently large that a detailed comparison will have to await another occasion. See his paper for more details.

emerging only because constructions like polar questions ($?\phi$), modals ($\Diamond\phi$) (and perhaps other constructions) happen to give a certain 'priviledged' semantic status to p-worlds/states.

4.7. Conclusion

This chapter presented a response to the challenge identified by Enguehard 2021 regarding the generalization of projection patterns to coordinations of polar questions: we argued, contra Enguehard 2021, that the data should not be handled by moving to a trivalent inquisitive denotation for questions that semanticizes the various (a-)symmetries of projection, as this leads to theoretical and (especially) empirical problems. Instead, it is enough to generalize the *Limited Symmetry* approach to classical inquisitive question denotations, by reasoning about the overall polarity of a response to a given question. Seen from a high-level perspective, the idea was that polar questions introduce discourse referent that are used by compreheders to reason about polarity to possible responses during incremental interpretation: for a conjunction, knowing that the declarative underlying the first conjunct is false determines the overall polarity of the response as negative, no matter the second conjunct. If we take presuppositions to be operative at this level of reasoning (as formalized with our extension of *Limited Symmetry*), then the conjunction data fall out. Furthermore, we make a prediction that disjunctions of polar questions should show symmetry (just like their declarative counterparts, although as noted the issue is empirically complex). Thus, *Limited Symmetry* represents an approach to presupposition projection that scales nicely to questions in a way that is fully general and predictive.

Chapter 5

Symmetric filtering and negation: An experimental investigation

5.1. Introduction

This chapter presents an experimental investigation of a novel prediction made by System 1 of *Limited Symmetry* (see chapter 3, section 3.4.5). The predictions concerns sentences like the following:

(1) a. If Mary is going to the new show again, and s*he went to it last week*, then she's just in town for shopping today.

b. If Mary **isn't** going to the new show again, and *she went to it last week*, then she's just in town for shopping today.

In both (1a) and (1b), there is a conjunction embedded in the antecedent of a conditional: the first conjunct carries a presupposition, whereas the second conjunct carries information that has the potential to filter this presupposition. The question is whether or not this is possible: System 1 of *Limited Symmetry* predicts that filtering should be possible only in the version where the first conjunct is negated, whereas System 2 of the theory (as well as other approaches to the filtering problem) predict no filtering either in (1a) or (1b) (although again there are additional complications, see section 5.4).

We aim to test this by conducting two experiments following the paradigm of Mandelkern et al. 2020 and Kalomoiros & Schwarz Forth (chapter 2). Our results are somewhat conflicting: experiment 1 finds support for the prediction that filtering should occur in (1b) but not in (1a); experiment 2 however contradicts this finding, producing a picture more in line with a theory that takes the presupposition in the first conjunct to resist filtering from the second conjunct regardless of the presence of negation (although both experiments come with their complications. See section 5.5 for discussion).

The rest of this chapter is organised as follows: section 2 provides some background on the problem of presupposition projection and introduces briefly the various versions of *Limited Symmetry*, with a focus on the prediction regarding the cases in (1). Section 3 introduces the general design upon which both experiments are founded, and dives into experiment 1. Section 4 presents experiment 2. Section 5 discusses potential confounds that might have hindered the emergence of a clear picture in the two experiments and suggests improvements for future experimental forays into these issues. Section 6 concludes.

5.2. Theorizing the (a-)symmetries of projection

5.2.1. Symmetric vs asymmetric filtering

A classic pattern with respect to presupposition projection goes as follows:

(2) a. #Mary stopped smoking and used to smoke.

b. ✓Mary used to smoke and stopped smoking.

Intuitively, there is a contrast between (2a) vs (2b), with (2b) being more acceptable. This has been understood as follows: (2a) as a whole carries the presupposition of it's first conjunct that Mary used to smoke; thus in the absence of a common assumption that Mary indeed used to smoke, (2a) appears infelicitous, despite the fact that the second conjunct introduces the information that 'Mary used to smoke'; this information appears to come too late.

On the other hand, (2b) reverses the order of the conjuncts, and now the information that 'Mary used to smoke' comes first. This makes the sentence perfectly felicitous, in contrast with (2a). It seems then that the **order** in which information is presented matters when dealing with presuppositions: a presupposition in the first conjunct becomes a presupposition of the entire sentence (i.e., it projects), creating infelicity unless satisfied in the common ground, whereas a presupposition in the second conjunct need not project, as long as the relevant presupposition is introduced by the first conjunct. In the latter cases, we say that the presupposition of the second conjunct is **filtered** (i.e. rendered in some sense inert), in the terminology of Karttunen 1973, by the presupposition of the first conjunct.

Filtering then in conjunction appears asymmetric in that it depends on order: it happens from left to right, but not from right to left. The core question to ask with respect to filtering is whether such asymmetries are a property of the semantics of a given connective (i.e. something to stipulate in the lexical entry of 'and'), or can be derived in a predictive way from some independent principle. In particular, the fact that the asymmetry of conjunction appears dependent on **order** opens up the question of whether the asymmetry is an artifact of the fact that language is interpreted incrementally in time, which flows asymmetrically from the past to the future. This is essentially the position taken by Stalnaker,(Stalnaker, 1974), who took the contrast in (2) to derive from incremental interpretation: in (1b), comprehenders initially get access to the first conjunct, which introduces the information that Mary used to smoke. This information becomes part of the common ground, because a conjunction asserts the truth of both of its conjuncts. The presuppositional second conjunct then is interpreted against a context that already entails the information that Mary used to smoke. Conversely, (1a) the comprehender gets access to the first conjunct which already contains a presupposition. In the absence of supporting information in the context, there is nothing to justify the presupposition and infelicity ensues. The second conjunct hasn't been encountered yet, and comes too late.

One could then hypothesize that all filtering shows the same kind of asymmetry exhibited by conjunction. In that case no asymmetry needs to be stipulated in the semantics of connectives, as it can be taken to derive from the way comprehenders interpret language incrementally. The issue with this view has always been that at least some connectives behave symmetrically with respect to filtering. The poster child for this behavior is disjunction, (Hausser, 1976; Soames, 1982; Schlenker, 2009), and much subsequent work; see also chapter 2):

(3) a. Either Mary stopped smoking or she never used to smoke.

b. Either Mary never used to smoke or she stopped.

The sentences in (3a) and (3b) carry no presupposition that Mary used to smoke. It seems that the sentence 'Mary didn't use to smoke' can be used to filter the presupposition regardless of whether it appears a first or second disjunct.[111]

Three basic kind of response are possible here: 1) The difference in (a-)symmetry between (2) and (3) is real, and is cause for abandoning the idea that asymmetries should not be stipulated in the lexical entries of connectives. 2) The difference in (a-)symmetry between (2) and (3) is real, but there is a way of predicting when a connective will show symmetric vs asymmetric filtering. So, nothing needs to be stipulated in the lexical entry yet. 3) The difference in (a-)symmetry between (2) and (3) is not real.

Of these three option, the one pursued in recent work (Schlenker, 2008, 2009; Rothschild, 2011, a.o.) is the third one. On this approach, the basic filtering mechanism is taken to be fundamentally symmetric. However, because of incremental interpretation there is a domain-general preference for asymmetric readings, with the symmetric alternative being available at a processing cost (as one has to override a processing default). This makes the following prediction:

(4) **Costless asymmetry, costly symmetry:** All connectives have the same filtering profile, preferring asymmetric filtering but allowing access to symmetric filtering at a cost.

Recent experimental evidence however presents a challenge for this kind of approach: a core finding of Mandelkern et al. 2020 found that the asymmetry of conjunction is strict, not allowing much access to symmetric interpretations. At the same time, Kalomoiros & Schwarz (Forth.) (see chapter 2) contrasted conjunction and disjunction in terms of filtering properties and found that there is a genuine difference between the two connectives: disjunction allows much easier access to symmetric readings compared to conjunction. Therefore, in light of these results, the idea that all connectives behave in fundamentally the same way with respect to filtering (a-)symmetries appears in need of revision.

[111]The general filtering rule for disjunction then is that a presupposition in some disjunct is filtered if the negation of the other disjunct entails that presupposition, (cf. Karttunen 1973).

Chapter 3 presented an exploration of the second option alluded to above: avoiding the stipulation of asymmetries, but rather deriving which connectives prefer asymmetric filtering vs which prefer symmetric filtering. We briefly review the basic ideas of the three approaches we explored in chapter 3 on our way to presenting a core case where these approaches part ways: that of negated conjunctions.

5.2.2. Limited Symmetry: Bivalence

We start with *Limited Symmetry*. We give a somewhat condensed and simplified presentation. For more details the reader is instructed to consult chapter 3.

Limited Symmetry begins from the Schlenkerian idea that the presuppositional component of meaning is under a constraint of non-informativity, embodied in the following idea of Transparency (Schlenker 2007, Schlenker 2008):

(5) **Transparency:** (adapted from Schlenker 2007) A sentence S is presuppositionally acceptable in a context C just in case for every $p'p$ in S, it holds that:

- For all p: $C \models \alpha\ p'p\ \beta \leftrightarrow \alpha\ p\ \beta$

Here $\alpha\ p'p$ is a substring of S that starts at the beginning of S and goes up to $p'p$. β represents the part of S after $p'p$. $p'p$ is a sentence with a presuppositional component p' and an assertive component p. It is understood as a conjunction of p' and p in a bivalent classical semantics. The rest of the semantics is also fully classical, and hence free of any order-related stipulations (see the previous chapters for more discussion of these assumptions).

What the definition in (5) says is that a presuppositional component of a sentence $p'p$ (embedded in a perhaps larger sentence S) should be removable without any change in the truth conditions of S in a context C, and that this should hold regardless of the assertive component p. In other words, the version of S with $p'p$ should be equivalent to the version of S without p' (for all p). The overall presupposition carried by a sentence S is identified with what needs to hold in a context C

so that S satisfies Transparency in C.

As it stands, Transparency produces symmetric results for all connectives. It can be incrementalized in a way that will produce asymmetric filtering conditions for all connectives (see Schlenker 2008 for more). As such it represents a framework that is very friendly to the idea that all filtering is underlyingly symmetric, with asymmetry resulting from processing considerations: both the symmetric and asymmetric versions of Transparency are in principle available to speakers, with the asymmetric one being the default, and the symmetric one being available at a cost.

Limited Symmetry assumes that there is something right about the symmetric definition of Transparency. However, it proposes a different way of incrementalizing Transparency. Specifically, it puts forth the hypothesis that comprehenders are aiming to build the equivalence imposed by Transparency incrementally, as they are parsing a sentence from left to right.

As soon as they hit a $p'p$ component in a sentence S, they know that the overall goal is for p' to be removable without change in the truth conditions of S, for all p. Practically, this means the following:

(6)
- For all p: $C \models S \rightarrow S_{p'p/p}$
- For all p: $C \models \neg S \rightarrow \neg S_{p'p/p}$

Here, $S_{p'p/p}$ is the version of S where $p'p$ has been replaced by p. If one can establish the two conditionals in (6), then one has established the bi-conditional required by Transparency. What the two conditionals are saying are that all the worlds where S is true (or false) are worlds where $S_{p'p/p}$ is true (or false). The interesting thing here is one can start checking these requirements even if they haven't parsed S to completion, and this is exactly what *Limited Symmetry* assumes that comprehenders do.

For example consider a conjunction of the form ($p'p$ *and* q). Assume that comprehenders are parsing this from left to right, symbol by symbol. When they reach the 'and', they have parsed `(p’p and`.[112] At this point, they know that the sentence is already false in worlds where $p'p$ is false. Because of the bivalent nature of the logic, $p'p$ is false just in case p' is false or p is false. So, comprehenders can check whether, for these worlds, the second conditional in (6) holds. This boils down to checking whether:

(7) For all p: $\{w \in C|\ p' = 0\ \mathit{or}\ p = 0\} \subseteq \{w \in C|\ p = 0\}$

It turns out that this holds just in case $C \models p'$. Therefore, already at this point, trying to check as much of the Transparency constraint as you can at the worlds where the truth value of the sentence is determined, imposes a requirement on the context. We can identify this requirement as a presupposition carried by the sentence: unless it is satisfied, the sentence suffers presupposition failure.

On the other hand, in a conjunction like $(q\ \mathit{and}\ p'p)$, the parser needs to parse up to `(q and p’p` before they encounter a presupposition-bearing sub-sentence. At that point, they know all the worlds in the context where the sentence is true and all the worlds where it's false, so checking the two conditionals is equivalent to checking the original Transparency constraint. We know from Schlenker 2007 that this imposes a requirement that $C \models q \rightarrow p'$, which is exactly the filtering condition we want.

Things work very differently in a disjunction like $(p'p\ \mathit{or}\ q)$. In paring this from left to right, at some point a comprehender reaches `(p’p or`. At this point, they know that the sentence is already true in worlds where $p'p$ is true. So, they check whether the first conditional in (6) holds in these worlds. This boils down to:

(8) For all p: $\{w \in C|\ p' = 1\ \mathit{and}\ p = 1\} \subseteq \{w \in C|\ p = 1\}$[113]

[112] As in previous chapters, the `verbatim` font is used to refer to partial syntactic objects.

[113] We take a context to be a set of possible worlds (those worlds compatible with the shared assumptions of the interlocutors, (Stalnaker, 1978).

This is clearly a trivial requirement. So no requirement is imposed at this point and the parse moves on to `(p'p or q`. At this point, one can compute all the worlds in the context where the sentence is true/false and hence check both conditionals in (6). The interesting case is the second conditional, which boils down to:

(9) For all p: $\{w \in C|\ (p' = 0\ or\ p = 0)\ and\ q = 0\} \subseteq \{w \in C|\ p = 0\ and\ q = 0\}$

It turns out that this holds just in case $C \models \neg q \rightarrow p'$. Therefore, the presupposition of a first disjunct causes presupposition failure unless entailed by the negation of the second disjunct. These are exactly the symmetric filtering conditions that we want for disjunction. Moreover, the reasoning works out in the same way if one were to apply it to $(q\ or\ p'p)$.

Therefore, having the Transparency requirement be computed piecemeal in this way as comprehenders get incremental access to worlds where a sentence is true/false derives symmetric filtering for disjunction, but not for conjunction.

So far, we have kept the logic fully bivalent: presuppositions are treated by the semantics as normal parts of the meaning of a sentence, and their special behavior derives from imposing a version of Transparency. In the next subsection we show that good results for these basic cases can also be derived if we assume an underlyingly trivalent logic that treats presuppositions differently *in the semantics.*

5.2.3. Limited Symmetry: Trivalence

Let's assumed a trivalent semantics where a sentence $p'p$ is undefined, #, in a world w if $p' = 0$; the job of the logic is to tell us how the undefinedness of simple sentences gets treated in complex sentences; this represents a hypothesis about how failure of the presuppositions of a simple sentence is handled in larger sentences. Therefore, in contrast to the previous system, the semantics now is sensitive to a dimension of presupposition.

The usual move in trivalent accounts of presupposition is to derive filtering conditions by asking what needs to hold for a given sentence to not be undefined. Here we use trivalent logic somewhat differently. We assume that comprehenders apply a version of the Transparency constraint, as they are parsing a sentence from left to right. Recall that establishing Transparency means establishing an equivalence between a sentence S carrying a $p'p$, and the version of S where p' has been removed. However, because our underlying semantics is no longer bivalent, we need a different notion of equivalence:

(10) A sentence S is equivalent to a sentence S' iff S and S' are true in the same worlds, and undefined or false in the same worlds.

One way of understanding this is to view undefinedness and falsity as being grouped together, the intuition being that they both represent a kind of untruth. So S and S' above need to be true in the same cases and non-true in the same cases. This is equivalent to the following:[114]

(11)
- $\{w \mid S \text{ is true}\} \subseteq \{w \mid S_{p'p/p} \text{ is true}\}$
- $\{w \mid S \text{ is not true}\} \subseteq \{w \mid S_{p'p/p} \text{ is not true}\}$

The basic *Limited Symmetry* idea is as above: comprehenders check whether (for all p) for the worlds in the context where they know S to be true/not true at a given point in the parse, $S_{p'p/p}$ is also true/not true in these worlds.

The question now is what trivalent logic should we choose to apply our modified reasoning to. A common choice in this respect is Strong Kleene, (Kleene, 1952; George, 2008a, a.o.), as it

[114]To see this, suppose that the condition in (11) holds. We need to show that (1) S and $S_{p'p/p}$ are true in the same worlds; (2) S and $S_{p'p/p}$ are not true in the same worlds. For (1) to hold, it needs to be the case that all worlds where S is true are worlds where $S_{p'p/p}$ is true (trivial under the assumption that (11) holds), and that all the worlds where $S_{p'p/p}$ is true are worlds where S is true. To see that this last assertion holds, suppose that there is a world where $S_{p'p/p}$ is true, but S is not true. By the second bullet point in (11), this world is a world where $S_{p'p/p}$ is not true. But then $S_{p'p/p}$ is both true and not true in w, which is a contradiction. For (2) to hold, it needs to be the case that all worlds where S is not true are worlds where $S_{p'p/p}$ is not true (trivial under the assumption that (11) holds), and that all the worlds where $S_{p'p/p}$ is not true are worlds where S is not true. To see that this last assertion holds, suppose that there is a world where $S_{p'p/p}$ is not true, but S is true. By the first bullet point in (11), this world is a world where $S_{p'p/p}$ is true. But then $S_{p'p/p}$ is both true and not true in w, which is a contradiction.

$p \wedge q$	T	F	$\#$
T	T	F	$\#$
F	F	F	F
$\#$	$\#$	F	$\#$

Table 5.1: Strong Kleene conjunction

$p \vee q$	T	F	$\#$
T	T	T	T
F	T	F	$\#$
$\#$	T	$\#$	$\#$

Table 5.2: Strong Kleene disjunction

can be derived from classical logic. We briefly illustrate the point with respect to to Strong Kleene conjunction and disjunction, stated in the tables below.[115]

Consider a conjunction like ($p'p$ *and* q). At parsing point `(p'p and` comprehenders know that the sentence is not true in worlds where either p' or p fail. Thus they can check whether:

(12) For all p: $\{w \in C|\ p' = 0 \textit{ or } p = 0\} \subseteq \{w \in C|\ p = 0\}$

This then is as in *System 1* above, and imposes the requirement that $C \models p'$. For (q *and* $p'p$) the same result as in *System 1* also holds, imposing the requirement that $C \models q \rightarrow p'$.

For a disjunction like ($p'p$ *or* q) at parsing point `(p'p or` the comprehender knows that the sentence is true in worlds here $p' = 1$ and $p = 1$. Therefore, they check:

(13) For all p: $\{w \in C|\ p' = 1 \textit{ and } p = 1\} \subseteq \{w \in C|\ p = 1\}$

As in *System 1*, this holds trivially. The parse moves on to `(p'p or q`, and again things turn out just like *System 1*, ending up with a requirement that $C \models \neg q \rightarrow p'$. And again, the same requirement is imposed for (q *or* $p'p$).

Given the similarity of results, one might start wondering if we need the extra baggage that trivalence comes with in order to derive asymmetric filtering for conjunction, but symmetric filtering

[115]The issue of how to handle conditionals is complicated and we will not go into it here. Suffice it to say that while Strong Kleene material implication will not do for our purposes, one can find a truth table for trivalent implication that derives from classical logic and serves well for the cases that are of interest to us. See chapter 3 for discussion on these issues.

for disjunction. We will see that the two systems part ways once negation gets involved; but before that, we introduce one final variation on the symmetric disjunction vs asymmetric conjunction motif.

5.2.4. A Dynamic alternative

The two *Limited Symmetry* systems introduced so far share the following property: the algorithm that underlies them works **linearly** on a string representation of a sentence S: comprehenders proceed by reading the string from left to right, symbol by symbol. In some ways, this is inherited from the Transparency constraint, which applies globally on strings, rather than recursively on the structure of strings (i.e. compositionally).[116] A theoretical question then arises: can we have a recursive system operating on the structure of a string that derives asymmetric conjunction, but symmetric disjunction?

One possible road ahead here is to modify a dynamic semantics system in a way that makes the right cut. I do not review dynamic semantics here, (Heim, 1983b; Rothschild, 2011); rather, I simply state the main idea behind the current approach, and point to chapters 2 and 3 for more exposition.

Suppose that the only initial constraint that an update of context C with a sentence S, $C[S]$, is that the update result in a context where all worlds are such that the classical meaning of S is true. For example, the following rules are possible ways (among others) of defining $C[\alpha \wedge \beta]$:

(14) a. $C[\alpha \textit{ and } \beta] = (C[\alpha])[\beta]$

b. $C[\alpha \textit{ and } \beta] = (C[\beta])[\alpha]$

What is said in (14a) is that the result of updating C with (α *and* β) is equivalent to updating C with α (i.e. keeping the worlds in C where α is true), and then updating the result of that with β

[116] Although, both asymmetric and symmetric Transparency can be restated using a more compositional approach, that makes the same predictions, (Schlenker, 2007; Rothschild, 2008). Whether or not the intuitions behind *Limited Symmetry* can receive a more compositional treatment and the exact predictions such a move would make are topics left for future research.

(i.e. keeping the worlds where α is true and β is true). Clearly the same result can be achieved by updating C first with β and then with α, (14b).

On the classic way of defining when $C[S]$ is defined in dynamic semantics, in (14a), $C[\alpha \textit{ and } \beta]$ is defined just in case $C[\alpha]$ is defined and $(C[\alpha])[\beta]$ is defined. The effect of this is that if α is carrying any presuppositions, they should be true in all worlds in C, and if β is carrying any presuppositions, they should be true in all worlds in C where α is true. Similarly, (14b) is defined just in case all the presuppositions of β are true in C, and all presuppositions of α are true in the worlds in C where β is true.

If we take a $(\alpha * \beta)$ to be in principle associated with all possible updates that are truth-conditionally adequate (in the sense of leaving only worlds in the context where $(\alpha * \beta)$ is classically true), then we can take $(\alpha * \beta)$ to be defined in C iff at least one of the possible updates associated with it is defined in C, (Rothschild, 2011).

So, in the case of $(\alpha \textit{ and } \beta)$, $(\alpha \textit{ and } \beta)$ is defined in C if either C entails the presuppositions of α, and α entails the presuppositions of β, or C entails the presuppositions of β, and β the presuppositions of α. These are symmetric filtering conditions.

Similarly, truth-conditionally adequate update rules for a disjunction can take the following forms (among others):

(15) a. $C[\alpha \textit{ or } \beta] = C[\alpha] \cup (C[\neg\alpha])[\beta]$

b. $C[\alpha \textit{ or } \beta] = C[\beta] \cup (C[\neg\beta])[\alpha]$

So, $(\alpha \textit{ or } \beta)$ is defined in C if either C entails the presuppositions of α, and $\neg\alpha$ entails the presuppositions of β, or C entails the presuppositions of β, and $\neg\beta$ the presuppositions of α. Again, these are symmetric filtering conditions.

The trick now is to find a criterion that forces a preference for (14a) as the only way of updating with (α *and* β) (since in this case the filtering conditions are asymmetric), whereas no preference is forced for how (α *or* β) updates the context. The idea is to say that if given $S = (\alpha * \beta)$, then the worlds where α is true contain all the worlds where S is classically true or classically false, then the update rule for $C[S]$ has to take the following form:

(16) $$C[S] = \begin{cases} (C[\alpha])[\gamma], & \text{if all the worlds where } S \text{ is classically true are } \alpha\text{-worlds} \\ C - (C[\alpha])[\gamma], & \text{if all the worlds where } S \text{ is classically false are } \alpha\text{-worlds} \end{cases}$$

In both cases $\gamma \in \{\beta, \neg\beta\}$ depending on what produces a truth-conditionally adequate update. This forces, $C[\alpha$ *and* $\beta]$ to have the form $(C[\alpha])[\beta]$, which comes with asymmetric filtering conditions. But since for a disjunction (α *or* β) it doesn't hold that all the worlds where the disjunction is true/false are worlds where α is true, then the same constraint doesn't apply, and one has access to any truth-conditionally adequate update, this guaranteeing symmetric filtering conditions.[117]

5.2.5. Negated conjunction: the parting of predictive roads

We have seen three different ways of getting asymmetric filtering for conjunction, but symmetric filtering for disjunction. The obvious question to ask is: can we distinguish between them? The answer is yes; these three approaches are not equivalent, but make rather different predictions. Here we focus on the particular case of sentences like the following:[118]

(17) $([\neg p'p]$ *and* $q)$

Limited Symmetry 1: On this system, when a comprehender reaches `(¬p'p and` they know that the sentence is false in worlds where $p'p$ is true. So, they check whether:

[117] Clearly, this criterion forces presuppositions to always project from the antecedent of conditionals as well. In a conditional $S = (\alpha \to \beta)$ all the worlds where S is false are worlds where α is true. Hence, the update rule for a conditional is:

(i) $C[\alpha \to \beta] = C - (C[\alpha])[\neg\beta]$

[118] The three systems diverge with respect to other cases as well. See chapter 3 for more detailed comparisons.

(18) For all p: $\{w \in C|\ p' = 1\ \mathit{and}\ p = 1\} \subseteq \{w \in C|\ p = 1\}$

This holds trivially. The parse moves on to `(¬p’p and q` and from them on things work just like the (q *and* $p'p$) case; the presupposition that is derived is that $C \models q \rightarrow p'$.

Limited Symmetry 2: On this system, when a comprehender reaches `(¬p’p and` they know that the sentence is non-true is worlds where $p' = 0$ or $p = 1$. So, they check whether:

(19) For all p: $\{w \in C|\ p' = 0\ \mathit{or}\ p = 1\} \subseteq \{w \in C|\ p = 1\}$

This holds just in case $C \models p'$.

Dynamics: Since on the dynamic system conjunction prefers the asymmetric way of updating contexts, we have:

(20) $C[\neg p'p\ \mathit{and}\ q] = (C[\neg p'p])[q]$

For this to be defined, all the worlds in C must be p' worlds, hence the presupposition imposed is that $C \models p'$.

5.2.6. Interim summary

We have introduced three different systems that predict (at least in some simple cases) symmetric filtering for disjunction, but asymmetric filtering for conjunction. We saw that they diverge in their predictions with respect to conjunctions where the first disjunct is negated. The rest of the chapter is devoted to an experimental investigation of the presupposition landscape in terms of this prediction.

5.3. Experiment 1

5.3.1. Design

Mandelkern et al. We adapt a version of the Mandelkern et al. 2020 felicity-rating task that has been used to investigate filtering effects in conjunctions and disjunction (see also chapter 2). The main idea underlying this kind of design is to set presupposition-carrying sentences in so-called explicit ignorance contexts (Simons 2001, Abusch 2010). For example consider the following:

(21) a. **EI Context:** John wants to interview people who are former smokers. I have no idea if Mary has ever smoked, but I thought:

b. #If Mary has stopped smoking, then John will want to interview her.

In (21), a context is set up that denies any knowledge of Mary's past smoking habits. When therefore the conditional in (21b) is uttered in this context, the presupposition of the antecedent projects and comes into conflict with the explicit ignorance of the context.

Note that the only way to avoid the conflict resulting by projection is to somehow accommodate the presupposition. Since the presupposition that Mary used to smoke cannot be added to the context without creating a contradiction, the only option is that of local accommodation, essentially resulting in a conditional that is interpreted as follows (for more background on local accommodation see chapters 1-3):

(22) If Mary **used to smoke and** has stopped smoking, then John will want to interview her.

Local accommodation is taken to be a costly option, (Heim 1983b, Hirsch & Hackl 2014), which should be reflected as lower acceptability in an acceptability judgment task (this assumption as well support from it comes from Mandelkern et al. 2020; first experimental evidence for it comes from Chemla & Bott 2013, Romoli & Schwarz 2015).

Conversely, if (21b) is presented in a context that supports the presupposition (a so-called Support context), no extra operation to locally accommodate is required, and hence no presupposition-related infelicity should be present:

(23) a. **Context:** John wants to interview people who are former smokers. Mary used to smoke, but I have no idea if she still does. So, I thought:

b. ✓If Mary has stopped smoking, then John will want to interview her.

Thus, if a sentence carries a presupposition, this should result in low acceptability ratings in EI contexts, compared to S contexts.

The current study Following Mandelkern et al. 2020, we can use this idea to test whether negated conjunctions like (17) do not carry any presuppositions as long as the second conjunct entails the presupposition of the first conjunct, by embedding them in EI vs S contexts.

First note that a simple conjunction cannot be directly presented in an EI context, as asserting the conjunction would contradict the explicit ignorance:

(24) a. **Context:** I have no idea if John has ever visited Germany:

b. #Mary didn't find out that John visited Germany and John visited Berlin

This infelicity has nothing to do with presupposition failure; rather, asserting the second conjunct (that John has visited Berlin), contradicts our ignorance about him ever visiting Germany. Thankfully, the prediction about negated conjunction continues to hold when such conjunctions are embedded in the antecedent of conditionals (see chapter 3 for more on this), and by conditionalizing the conjunction, we avoid the problem above:

(25) If Sue **didn't find out** that Donald visited Germany and he visited Berlin, then that would be very strange. NEGCONJ

We used the following 6 triggers to construct our stimuli: *again, find out, happy, aware, continue, stop* (cf. Experiment 1 in chapter 2). We want to know whether or not conditionals that embed a conjunction in their antecedent can show symmetry in the case where the first conjunct is negated. As such we created two types of stimuli: conditionals that embed a negated conjunction (NegConj) and corresponding conditionals that match their NegConj counterparts but for the presence of the negation, NegConj vs SimpleConj. These were embedded in Explicit Ignorance (EI) and Support (S) contexts, giving us overall four conditions. Here is the full paradigm for (one of) the *find out* stimuli:

(26) a. **EI:** Sue likes to keep close tabs on her husband, Donald. One day I saw a ticket from the Berlin opera in Donald's office. I don't know whether Donald visited Germany, so I thought:

b. **S:** Sue likes to keep close tabs on her husband, Donald. One day I saw a ticket from the Berlin opera in Donald's office. I know that he visited Germany recently. So I thought:

(27) a. If Sue **didn't find out** that Donald visited Germany and he visited Berlin, then that would be very strange. NegConj

b. If Sue **found out** that Donald visited Germany and he visited Berlin, then she must know about the opera ticket. SimpleConj

For every one of the six triggers, two distinct items were created in each of the four conditions listed above (12 critical items in total). There were also 12 fillers; these took the form of simple non-presuppositional conditionals, and came in two kinds. The first kind, GoodCond, was a conditional whose antecedent could be true in the context. The second kind, BadCond, was a conditional whose antecedent was explicitly false in the context:

(28) a. **Context:** My friend Saul is a philosopher and has been working on a new theory for

the past year. However, he has been very secretive about it. Yesterday he told me that he was almost done with the work, but given how secretive he has been I'm not sure whether he will publish it. So, I thought:

b. If Saul publishes his new theory, then that will make the other philosophers very excited.

(GoodCond)

(29) a. **Context:** The Louvre has a new exhibition of medieval art. Melanie is an art critic and is in Paris to review the new exhibition. So I thought:

b. If Melanie isn't in Paris then something must have happened on her trip. (BadCond)

The Good/BadCond fillers were designed to implement the following manipulation (present also in the fillers of Mandelkern et al.): generally, a conditional is infelicitous when the antecedent is excluded as a possibility in the context. The BadCond fillers took this form, while in GoodCond fillers the context allowed the antecedent as a possibility. Adding these fillers allowed for an independent assessment of sensitivity to pragmatic infelicity of broadly comparable severity to presupposition failure. Moreover, introducing another source of infelicity also served to distract participants from our critical manipulation.

5.3.2. Predictions

If all of our triggers behave as *System 1* would predict, then items in the EI-NegConj condition should not carry a presupposition. The same items in Support contexts also never carry a presupposition; thus, we expect no contrast between EI-NegConj vs S-NegConj in terms of acceptability, as both involve costless filtering.

The simple conjunctions on the other hand carry a presupposition, which is not supported in EI contexts, but is supported in S contexts. In EI contexts this presupposition has be locally accommodated, which we have argued comes with a cost. On the other hand, no accommodation is required in S contexts. Thus, we expect a contrast between EI-SimpleConj and S-SimpleConj.

Overall then, the difference between EI vs S must be greater for SimpleConj than for NegConj. Viewing EI vs S as two levels of a factor called ContextType and the NegConj vs SimpleConj as two levels of a factor called ConjunctionType we then expect an interaction between ContextType on the one hand, and ConjunctionType on the other.

Conversely, If our triggers behave like *System 2* or the dynamic system, then we expect a contrast between EI-NegConj vs S-NegCon, as in both cases a presupposition is predicted, and that presupposition needs to be locally accommodated in the case of EI-NegConj, but not in the case of S-NegConj. The same contrast should be there for EI-SimpleConj vs S-SimpleConj; therefore, the interaction that System 1 predicts between ConjunctionType and ContextType vanishes in this case.

Finally, a possibility to keep in mind is that of a mixed system, where some triggers behave like the predictions of *System 1* whereas others do not. In that cases, the overall results might not be hugely informative. Instead one will have to look at the results for subclasses of triggers that behave similarly, and see whether natural classes of triggers can be discerned on a post-hoc basis.

5.3.3. Participants & Procedure

153 participants (all native English speakers) were recruited from our university's subject pool. There were four groups that counterbalanced the four conditions in a Latin square design. Within each group, in each condition, every participant saw items from three distinct triggers (one item per trigger). For instance in Group A, for the EI-NegConj condition, participants saw items associated with *again, stop, continue*; For the EI-SimpleConj condition, they saw items associated with *find out, happy, aware.* This grouping of triggers was carried over to the remaining two conditions (S-NegConj, S-SimpleConj); but since each trigger was associated with two distinct items, no items were repeated across conditions. There were also 12 fillers. So, in total there were 24 items, which were presented in a random order. Participants saw a context and a sentence, and had to indicate on a 9-point scale how felicitous a sentence sounded in the given context. A demonstration version as well as the underlying code and the csv-file containing the full stimuli are accessible at

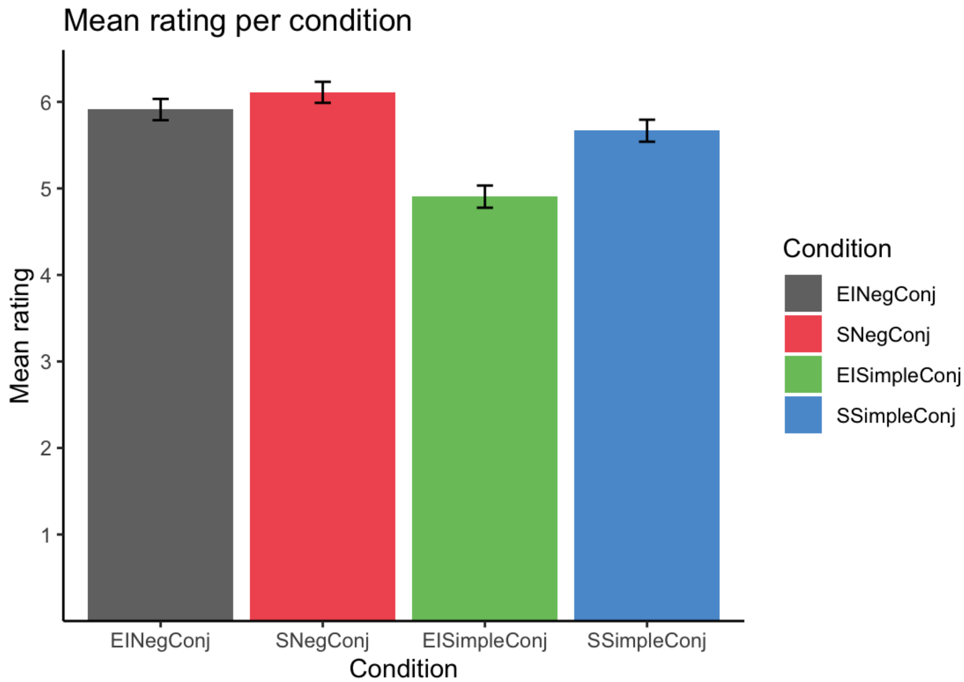

Figure 5.1: Mean acceptability across triggers. Error bars represent standard error.

https://farm.pcibex.net/r/AUyZNv/.[119] The full list of stimuli is also available in appendix B.

5.3.4. Results

A visualization of the overall results is presented in Fig 5.1. It is quite clear that the difference in acceptability for the NegConj conditions between EI vs S contexts is much less than the corresponding difference for the SimpleConj conditions. Thus, numerically, we have an interaction between ContxtType and ConjType.

To evaluate the statistical significance of this interaction, we set up the two factors ContxtType and ConjType. Both of the factors were sum-coded. We then fit an ordinal mixed effects model predicting the rating from ContxtType, ConjType and their interaction. The final model also included by-participant and by-item random intercepts. By-item random slopes for ContxtType and ConjType were also included as well as a by-participant random slope for ContxtType. The outcome of this model is summarized in Table 5.3: there are significant

[119] Click on 'Click here to edit a copy in the PCIbex Farm.' in the top bar to access code and stimuli directly (no account or sign-in needed) on the PCIbex Farm (Schwarz & Zehr, 2021)

effects of both ConjType and ContxtType, as well as a significant ContxtType × ConjType interaction.

	Coeff.	SE	z	p
ConjType	0.26394	0.13374	1.974	0.04843
ContxtType	-0.22852	0.07092	-3.222	0.00127
ConjType × ContxtType	0.10218	0.04236	2.412	0.01586

Table 5.3: ConjType × ContxtType ordinal mixed-effects model summary

To assess the nature of the interaction more directly, we carried out planned comparisons using the *emmeans* package with Bonferroni-corrected p-values. This reveal that the difference between EI-NegConj vs S-NegConj did not rise to significance ($\beta = -0.2527$, $SE = 0.165$, $z = -1.533$, $p = 0.4179$), whereas the difference between between EI-SimpleConj vs S-SimpleConj did ($\beta = -0.6614$, $SE = 0.166$, $z = -3.995$, $p = 0.0004$). This confirms that the ConjType × ContxtType interaction is driven by the fact that the difference between EI-SimpleConj vs S-SimpleConj is much larger than the difference between textscEI-NegConj vs S-NegConj.

5.3.5. Discussion

At a first level of analysis, the presence of the ConjType × ContxtType interaction is in accordance with the predictions of *System 1* of *Limited Symmetry*, and against the predictions of *System 2* and the dynamic system. It must be emphasized that this is a novel result and one which no mainstream approach to projection predicts.

However, there are two important qualifications that prevent a wholesale adoption of this conclusion. First, the pattern whereby EI-NegConj and S-NegConj are equally acceptable, whereas EI-SimpleConj and S-SimpleConj contrast, is not present across all triggers when one looks at the results at that level of granularity. As depicted in Figure 5.2, *stop* and *continue* show a contrast in both the *NegConj* and *SimpleConj* cases, which would be the overall outcomes expected on *System 2* and the dynamic system. On the other hand, the rest of triggers exhibit a weaker contrast between EI-SimpleConj and S-SimpleConj. While part of this picture may be attributable to noise that creeps in when one looks at the results by trigger, it is still interesting that at least *stop* and *continue* numerically show a contrast between EI-NegConj vs S-NegConj,

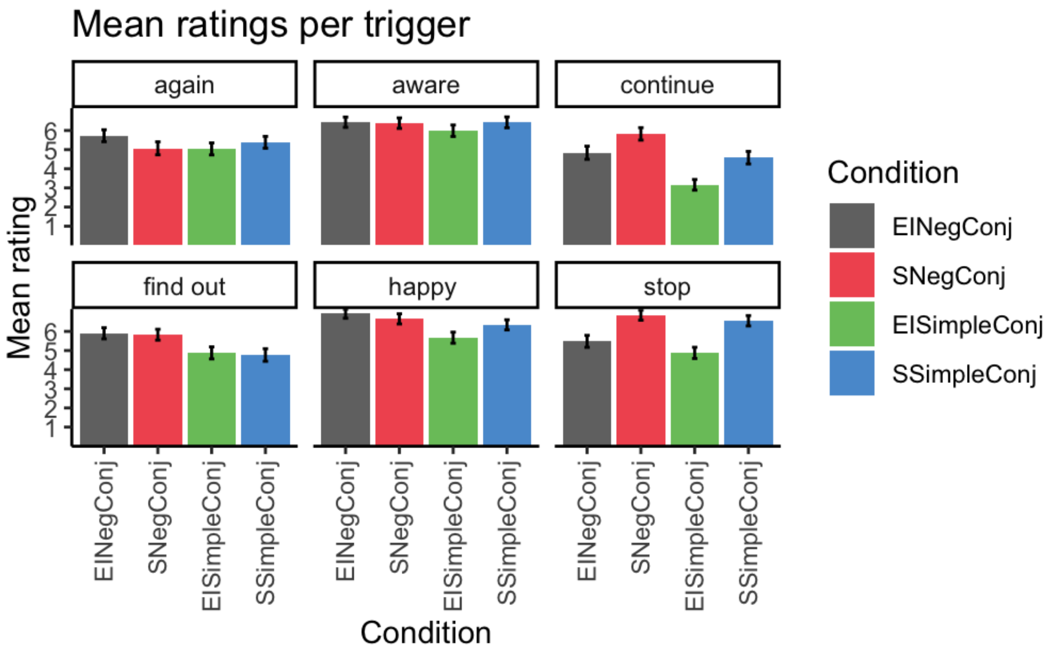

Figure 5.2: Mean acceptability by Trigger. Error bars represent standard error.

which is not really expected if the NegConj conditionals carry no presuppositions whatsoever. Therefore, there may be classes of triggers that indeed behave like *System 1* would predict, and triggers that do not. This should be clarified further in subsequent experimentation.

The second caveat has to do with a weakness of the design. The current implementation leaves the following possibility open: what if presuppositions in the scope of negation are easier to accommodate locally? Another way to think about this: might there be some mechanism that can get rid of a presupposition and is more easily available under negation? One bit of evidence that might tell against this is the difference between EI-NegConj vs S-NegConj we observed for *stop* and *continue*, which at least indicates that such a mechanism does not apply uniformly across triggers under negation. However, if this is a 'local accommodation'-like mechanism, such variability might be expected, since the availability of local accommodation itself has been argued to vary by trigger (see e.g. Abusch 2010, although change-of-state verbs like *stop, continue* are often taken to be 'soft triggers' that allow easier access to local accommodation, (Abusch, 2010; Abrusán, 2011)). At any rate, since our design does not offer an explicit comparison between NegConj sentences and sentences where the only way to avert presupposition failure is local accommodation, one cannot rule this option out.

5.4. Experiment 2

Given the caveats that surround the results of Experiment 1, Experiment 2 aimed to get a clearer picture by focusing on a subset of triggers, while controlling in a more direct way for the ease of local accommodation under negation.

5.4.1. Design

Just like Experiment 1, the stimuli of Experiment 2 consisted of conjunctions embedded in the antecedent of a conditional. However, there were three important differences.

First, the stimuli were constructed from two triggers, *again* and *too*, instead of the six triggers of Experiment 1. These were selected as they are traditionally assumed to be triggers of the same type: they are both *anaphoric* (Kripke 2009, Heim 1990) and resist local accommodation (i.e. they are so-called *hard triggers*; for more on the *soft-hard* trigger distinction see Simons 2001, Abusch 2010 a.o.).

The second difference had to do with the fact we chose an order-based manipulation instead of a context-type manipulation in order to bring out the effects of presupposition failure. Thus, the conditions corresponding to NegConj and SimpleConj of Experiment 1 now took the following form:[120]

[120] It will be noted that the negation in our NegPs stimuli took the periphrastic form 'it is not the case that ...' This was done to avoid scoping ambiguities. Consider the following:

(i) If Mary didn't go to the new show again, and she went to it last week, then she's just in town for shopping today.

A possible scope for the negation involves 'again' scoping above 'not', leading to a reading 'it is again not the case that Mary went to the new show'. While the next conjunct (that Mary went to the new show last week) falsifies this reading, we thought it more prudent to steer clear of the potential processing difficulties the problematic scope might engender. We thus opted for the periphrastic negation, which clearly scopes over the entire first disjunct. To makes sure that the only crucial difference between the NegPs vs ConjPs stimuli was the presence or absence of 'not', we included the 'it's the case that ...' locution in the ConjsPs stimuli as well.

(30) a. **EI Context:** Mary lives outside the city but likes to visit in order to go to the theater whenever there's a new show, often going twice to every show. The other day, I saw her in the city, shopping close to the theater. I have no idea if she's been to the new show so far, but I thought:

b. If it's not the case that Mary is going to the new show again, and it is the case that she went to it last week, then she's just in town for shopping today. NegPsFirst

c. If it's the case that Mary went to the new show last week, and it is not the case that she is going to the it again, then she's just in town for shopping today. NegPsSecond

(31) a. **EI Context:** Mary lives outside the city but likes to visit in order to go to the theater whenever there's a new show, often going twice to every show. The other day, I saw her in the city, shopping close to the theater. I have no idea if she's been to the new show so far, but I thought:

b. If it's the case that Mary was going to the new show again, and it is the case that Mary went to it last week, then she isn't just in town for shopping today. ConjPsFirst

c. If it's the case that Mary went to it last week and it is the case that she was going to the new show again, then she isn't just in town for shopping today. ConjPsSecond

Again, there are two kinds of conjunction negated (Neg) and unnegated (Conj). However, as it can be seen in (30) and (31), the context now is always a EI context, and it's the same across both conjunction types. But, each type of conjunction now comes in two variants: in the first variant, the presupposition is in the first conjunct and material that could filter the presupposition is in the second conjunct (Neg/ConjPsFirst), while in the second variant (Neg/ConjPsSecond) the opposite order is instantiated.

The idea is that in the Neg/ConjPsSecond conditions, the first conjunct always contains material that can filter the presupposition of the second conjunct. These conditions now act as a baseline that tell us what happens when a presupposition is supported, taking on the role played by the S conditions in Experiment 1 (with support being now local instead of global). The main advantage of making this change has to do with increasing the minimality of the design: all the NEG and CONJ conditions are presented in one constant context, with the only thing that changes between them being the place where the negation appears: in the presuppositional conjunct in NEGPSFIRST/SECOND or in the consequent of the conditional in CONJPSFIRST/SECOND.

The final difference has to do with the presence of conditions that explicitly control for the ease of local accommodation under negation. These took the form of simple conditionals that contained a negated presuppositional antecedent:

(32) If it's not the case that Mary is going to the new show again, then she's just in town for shopping today. SIMPLEPS

They were presented in EI and S contexts, in order to serve as a baseline for the availability of local accommodation in the way we reviewed in section 3.

(33) a. **EI Context:** Mary lives outside the city but likes to visit in order to go to the theater whenever there's a new show, often going twice to every show. The other day, I saw her in the city, shopping close to the theater. I have no idea if she's been to the new show so far, but I thought:

b. **S Context:** Mary lives outside the city but likes to visit in order to go to the theater whenever there's a new show, often going twice to every show.The other day, I saw her in the city, shopping close to the theater. I know that she went to the new show once already, so I thought:

For every trigger, 12 items were constructed in each of the 6 critical conditions listed above (NEGPSFIRST, NEGPSSECOND, CONJPSFIRST, CONJPSSECOND, EISIMPLEPS, SSIMPLEPS). Therefore, there were 24 critical items in total. The design also included the same kind of GOOD-

Cond vs BadCond fillers as Experiment 1, 12 of each kind (24 fillers in total).

5.4.2. Predictions

On *System 1*, NegPsFirst and NegPsSecond should be on par in terms of acceptability. The reason is that in both cases, the non-presuppositional conjunct can filter the presuppositions of the other conjunct, regardless of order. Conversely, ConjPsFirst and ConjPsSecond should contrast, with ConjPsFirst being less acceptable than ConjPsSecond. The reason is that ConjPsFirst carries the presupposition of the first conjunct, which means that in an EI context local accommodation needs to apply to get rid of it (which should decrease acceptability, per our assumptions about local accommodation), whereas normal costless filtering is available for ConjPsSecond. Therefore, suppose we restrict attention to the Neg/Conj-Ps-First/Second conditions: if we set up a factor Neg that classifies conditions as Neg vs NoNeg (depending on whether the antecedent contains a negation), and a factor Order that classifies conditions as First vs Second (depending whether the first or the second conjunct is presuppositional), we predict an interaction: the order of conjuncts should matter more in terms of acceptability in the NoNeg case, compared to the Neg case.

As far as the SimplePs conditions are concerned, we expect the application of local accommodation in the EI case, but not in the S case. On the assumption that explicit satisfaction of a presupposition (either through filtering or contextual support) is less costly compared to the deployment of local accommodation, we predict the following: SSimplePs and NegPsSecond should be on par, as they both involve costless satisfaction, the former via contextual support, the latter via filtering. However, NegPsFirst and EISimplePs should not be on par, as the first involves normal filtering on *System 1*, whereas the latter involves costly local accommodation. Therefore, if we set up a factor PriorSupport that classifies conditions as involving PriorSupport vs NoPriorSupport, and a factor AntType that classifies conditions as involving conditionals with a Simple antecedent vs conditionals with a Conj antecedent, we predict an interaction: the presence of prior support should increase acceptability more in the Simple conditionals, than in the Conj conditionals.

On *System 2* and on the dynamic system, no interaction is expected between Neg vs Order: both NegPsFirst and ConjPsFirst carry a presupposition that needs to be locally accommodated in EI contexts, whereas the Neg/ConjPsSecond cases involve costless filtering. At the same time, we do expect a contrast between NegPsFirst and NegPsSecond, in that the former should have lower acceptability than the latter: the reason is that in NegPsFirst local accommodation is required to get rid of the presupposition, whereas in NegPsSecond garden-variety asymmetric filtering is at play.

5.4.3. Participants and Procedure

139 participants (all native English speakers) were recruited using our university's subject pool. The conditions were grouped into two groupings. One grouping contained the items from the ConjPsFirst, ConjPsSecond, EISimplePs conditions, whereas the other grouping contained the items from the NegPsFirst, NegPsSecond, SSimplePs conditions. Each grouping also included the 24 fillers. This grouping of conditions was implemented as a between-subjects manipulation, where every participant was shown only items from one of these groupings. Within each grouping, the three conditions were counterbalanced using a Latin square design. Therefore, every participant saw 48 items in total in random order (12 critical items from the given grouping of conditions they were assigned to, plus the 24 fillers). Similarly to Experiment 1, participants saw a context and a sentence, and had to indicate on a 7-point scale how felicitous the sentence sounded in the given context. A demonstration version as well as the underlying code and the csv-file containing the full stimuli are accessible at https://farm.pcibex.net/r/xHKGGf/. The full list of stimuli is again available in appendix B.

5.4.4. Results

The overall pattern of results across all conditions is summarized in Figure 5.3. Surprisingly, the picture here is different from Experiment 1: the same kind of difference is present between both NegPsFirst vs NegPsSecond and between ConjPsFirst vs ConjPsSecond, suggesting the absence of an interaction between Neg and Order.

At the same time, we see that there is a difference in acceptability between EISimplePs vs SSimplePs, with the former being lower. And this difference appears bigger than the corresponding difference both between NegPsFirst vs NegPsSecond, and between ConjPsFirst vs ConjPsSecond. This suggests the presence of the PriorSupport $\times$ AntType interaction discussed above.

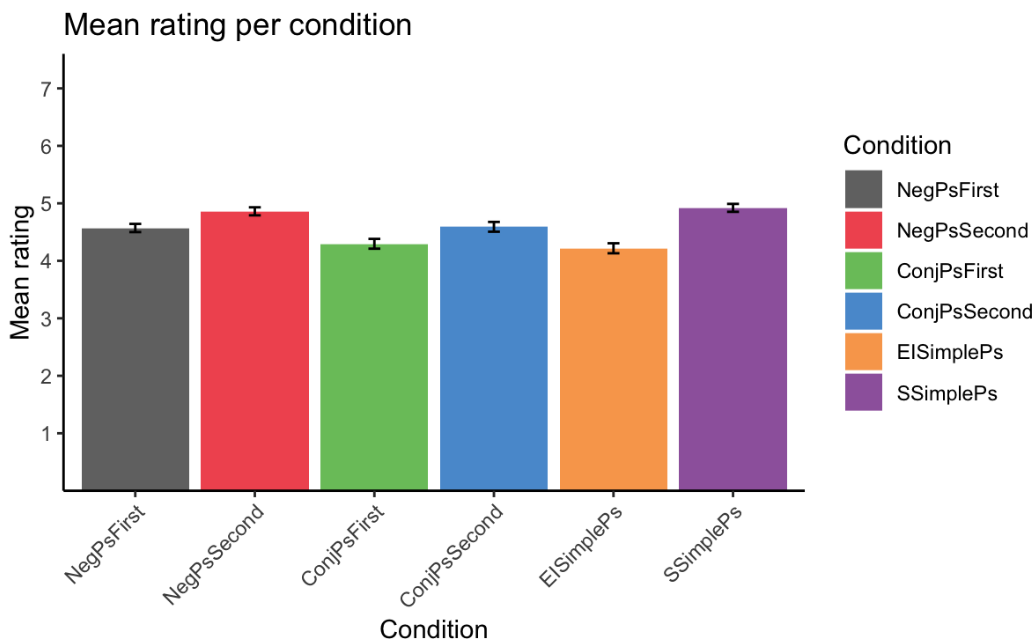

Figure 5.3: Mean acceptability by Condition. Error bars represent standard error.

To evaluate all this statistically, we first set up a factor Neg that classified our stimuli as involving the presence or absence of a negation in the antecedent (Neg vs NoNeg). We also set up a factor Order that classified our stimuli as involving a conjunction with a presuppositional vs non-presuppositional first conjunct (First vs Second). Subsequently, we fit a mixed effects ordinal model predicting acceptability from Neg, Order and their interaction. Both factors were sum-coded. The final model also included by-participant and by-item random intercepts, as well as a by-item random slope for Neg.[121] The results of this model are summarized in Table 5.4 below.

[121]The maximal model that converged included a by-item random slope for Neg, Order and their interaction. As not all participants saw items involving both levels of the Neg factor (recall the between-subjects nature of that factor), a by-participant random slope for Neg could not sensibly be included. Subsequent model comparison revealed that the by-item random slope for the interaction of Neg $\times$ Order did not significantly improve model fit ($p = 0.9848$). Neither did having a by-item random slope for Order ($p = 0.1701$). Including the Neg by-item random slope did siginficantly implrove model for ($p < 0.001$), although including the Order by-item random slope did not ($p = 0.9111$). As such the final model was simplified to include the random effects structure reported in the main text.

	Coeff.	SE	z	p
NEG1	0.186060	0.109194	1.704	0.0884
ORDER1	-0.174086	0.038801	-4.487	<0.001
NEG1 × ORDER1	-0.002348	0.038685	-0.061	0.9516

Table 5.4: CONJTYPE × CONTXTTYPE ordinal mixed-effects model summary

As Table 5.4 makes clear, there is a marginal effect of NEG ($\beta = 0.18$, $SE = 0.1$, $z = 1.7$, $p = 0.08$) and a significant effect of ORDER ($\beta = -0.17$, $SE = 0.03$, $z = -4.48$, $p < 0.001$), but no significant interaction between NEG × ORDER ($\beta = -0.002$, $SE = 0.03$, $z = -0.06$, $p = 0.9$).

We then carried out planned comparisons to separately check for the effects of ORDER on NEG with the *emmeans* package, using Bonferroni-corrected p-values. This revealed that the absence of the interaction is driven by the fact that there are significant differences both between NEGPSFIRST vs NEGPSSECOND ($\beta = -0.353$, $SE = 0.100$, $z = -3.527$, $p = 0.0004$), and between CONJPSFIRST vs CONJPSSECOND ($\beta = -0.343$, $SE = 0.118$, $z = -2.902$, $p = 0.0037$). While the presence of a significant difference between CONJPSFIRST vs CONJPSSECOND is expected under any theory of projection, the difference between the NEG conditions is unexpected under *System 1*. This will be discussed more in section 5.4.5.

To evaluate the presence of an interaction between PRIORSUP and ANTTYPE, we first restricted the data to the NEGPSFIRST/SECOND and EI/SSIMPLEPS conditions. We then set up a PRIORSUP factor that classified the NEGPSFIRST and EISIMPLEPS stimuli as NoPriorSup and NEGPSSECOND and SSIMPLEPS as PriorSup. The ANTTYPE factor classified the NEGPSFIRST and NEGPSSECOND stimuli as Conj and EISIMPLEPS and SSIMPLEPS stimuli as Simple. Both factors were sum coded. We then fit a model predicting the rating from ANTTYPE, PRIORSUP and their interaction. The final mode included by-participant and by-item random intercepts.[122] The outcome of it summarized

[122] The maximal model that converged included by-participant random slopes for ANTTYPE, PRIORSUP and their interaction, as well as by-item random slopes for ANTTYPE, PRIORSUP and their interaction. However, subsequent model comparison showed that including by-participant random slopes for the interaction between ANTTYPE and PRIORSUP did not significantly improve model fit ($p = 0.9999$). Neither did including the by-participant random slopes for ANTTYPE ($p = 0.8837$) and PRIORSUP ($p = 0.9374$). Model comparison also showed that including by-item random slopes for the interaction between ANTTYPE and PRIORSUP did not significantly improve model fit ($p = 0.9558$). Neither did including the by-item random slopes for ANTTYPE ($p = 0.9946$) and PRIORSUP ($p = 0.9043$). Hence, the random effect structure of the final model was simplified to include only random intercepts for participant, and item.

in table 5.5.

	Coeff.	SE	z	p
AntType1	0.09953	0.05546	1.795	0.0727
PriorSup1	-0.31577	0.05572	-5.667	<0.001
AntType1 × PriorSup1	0.14056	0.05552	2.532	0.0114

Table 5.5: AntType × PriorSup ordinal mixed-effects model summary

There is significant effect of PriorSup ($\beta = -0.31$, $SE = 0.05$, $z = -5.6$, $p < 0.001$), and a significant AntType × PriorSup interaction, ($\beta = 0.14$), $SE = 0.05$, $z = 2.53$, $p < 0.05$). Using the *emmeans* package to separately test for the effects of PriorSup on AntType, we find that this interaction is driven by the fact that there is a significant difference between Conj vs Simple in the NoPriorSup case ($\beta = 0.4802$, $SE = 0.1982$, $z = 2.423$, $p < 0.05$), but not in the PriorSup case ($\beta = -0.0821$, $SE = 0.0999$, $z = -0.821$, $p = 0.4116$). Essentially, this means that while SSimplePs and NegPsSecond do not differ significantly, EISimplePs and NegPsFirst do, with NegPsFirst being significantly higher in acceptability than EISimplePs. This means that the presence of the second conjunct in the NegPsFirst cases helps with acceptability in a way that is less costly than the local accommodation required in the EISimplePs case.

5.4.5. Discussion

The picture that the results above present us with is not uncomplicated. At first blush, it seems to contradict the predictions of *System 1*. There is no Neg × Order interaction, and there is a contrast between NegPsFirst vs NegPsSecond, whereby NegPsFirst is significantly worse in acceptability compared to NegPsSecond. This is not expected under a model where both NegPsFirst and NegPsSecond involve costless filtering.

At the same time, the comparison between PriorSup and AntType revealed that the presence of the second conjunct in NegPsFirst does indeed help: the difference between NegPsFirst vs NegPsSecond is less than the difference between EISimplePs vs SSimplePs. Since the contrast between EISimplePs vs SSimplePs provides a baseline for the cost of local accommodation, this tells us that the presence of the second conjunct in NegPsFirst helps ameliorate the acceptability of the sentence in a way that doesn't appear as costly as local accommodation. Since the other option for ameliorating the effects of the presupposition in our stimuli is filtering, this means that some amount of symmetric filtering is taking place in NegPsFirst.

On accounts like *System 2* and the dynamic system, the pattern whereby there is no Neg × Order interaction, and NegPsFirst is worse than NegPsSecond is expected. However, the fact that the second conjunct in NegPsFirst contributes to symmetric filtering requires an explanation. One avenue could be that symmetric filtering is always available as an option (even for connectives whose default filtering pattern is predicted to be asymmetric), but less costly than local accommodation. Recall after all that both *System 2* and the dynamic system involve ways of incrementalizing an algorithm that is underlyingly symmetric (a version of Transparency for *System 2*, and a fully symmetric dynamic semantics for the dynamic system).[123]

The idea that symmetric filtering is available at a cost (for connectives whose default filtering behavior is predicted to be asymmetric), makes a prediction that in the cases of simple conjunction in our stimuli we should see a parallel pattern: the difference between ConjPsFirst vs ConjPsSecond should be less than the difference between textscEISimplePs vs SSimplePs. Thus, when restricting the data to the ConjPsFirst/Second and EI/S-SimplePs conditions and setting up again the PriorSup and AntType factors, we should observe an PriorSup × AntType interaction.

Indeed, when these factors are set up and the corresponding statistical tests are applied, there is a significant interaction between PriorSup and AntType, summarized in table 5.6.[124]

[123] Some evidence for this claim might actually come from Experiment 2 in chapter 2; as can be seen in Fig 2.3, the difference between Conj-PsFirst vs Conj-PsSecond was less than the difference between EI-SimplePs vs S-SimplePs, suggesting the presence of costly symmetric filtering (we say *costly* because Conj-PsFirst and Conj-PsSecond were not on par, and there were clear effects of presupposition). This contrasts with the findings of Mandelkern et al. (2020) where there was no interaction between Conj-PsFirst/Second and EI/S-SimplePs. At the same time, the difference between the SimplePs conditions in the Disj part of Experiment 2 in chapter 2 parallels the difference between Conj-PsFirst vs Conj-PsSecond. Given that both the Conj and the Disj part of the experiment the SimplePs stimuli were parallel, this begs the question of why we see an interaction with the Conj SimplePs stimuli, but not with the Disj SimplePs stimuli. Therefore, further experiments are required to see if indeed there is generalized costly symmetric filtering that is available in spite of the differences across connectives in the availability of costless filtering.

[124] The maximal model that converged predicted the rating from AntType, PriorSup and their interaction, including random intercepts for participants and items, as well as by-participant random slopes for AntType, PriorSup and their interaction, as well as by-item random slopes for AntType, PriorSup and their interaction. Subsequent model comparison revealed the following: including the by-participant random slope for the interaction of AntType

	Coeff.	SE	z	p
AntType1	-0.09391	0.07526	-1.248	0.2121
PriorSup1	-0.28609	0.05294	-5.404	<0.001
AntType1 × PriorSup1	0.12127	0.05264	2.304	0.0212

Table 5.6: AntType × PriorSup ordinal mixed-effects model summary, restricted to Conj and Simple conditions.

However, when digging into this interaction using the *emmeans* package to separately test for the effects of PriorSup on AntType , we see that what's driving is the fact that ConjPsSecond is significantly worse than SSimplePs ($\beta = -0.4304$, $SE = 0.205$, $z = -2.094$, $p = 0.0362$), while ConjPsFirst and EISimplePs do not differ significantly ($\beta = 0.0547$, $SE = 0.159$, $z = 0.344$, $p = 0.7306$). However, the opposite pattern would be expected if symmetric filtering were an option here. Since in ConjPsFirst the second conjunct can be used to filter symmetrically the presupposition of the first conjunct in a way that is less costly than local accommodation, ConjPsFirst should be more acceptable EISimplePs. ConjPsSecondand SSimplePs on the other hand should be on par, as they both involve support for the presuppositions in the antecedents. Therefore, even though there is PriorSup × AntType interaction, it cannot be used to fully support the interpretation of costly symmetric filtering across the board.

Is there a way that this data is compatible with *System 1*? The answer is yes. One could imagine that when dealing with a conjunction where one conjunct is negated and the other isn't, it's more costly to have the negated conjunct be the first conjunct.[125] This could be due to an effect where interpreting a negation is contextually easier when part of the meaning of the larger conjunction where the negation is embedded has been computed. Then, while there wouldn't be any presupposition-related contrasts between NegPsFirstand NegPsSecond (both involve costless filtering), NegPsFirst would be expected to be worse than NegPsSecond, simply because in

and PriorSup did not significantly improve model fit ($p = 0.9461$). Neither did the by-participant random slope for AntType ($p = 0.5269$), or for PriorSup ($p = 0.5786$). Including a by-item random slope for the interaction between AntType and PriorSup did not significantly improve model fit ($p = 0.9942$). Including a by-item random slope for AntType did significantly improve model fit ($p = 0.002116$), while including a by-item random slope for PriorSup led to a model with very high correlations. As such, the final model included a random intercepts for participant and item, and a by-item random slope for AntType.

[125]Thanks to Chris Barker (pc) who suggested that adding negation might lead to processing costs, and whose comment led to the line of reasoning presented in this paragraph.

NEGPSFIRST the negation is in the first conjunct, and this carries an extra cost. On the other hand, CONJPSFIRSTand CONJPSSECOND are expected to contrast, as CONJPSFIRST is predicted to involve local accommodation (or at least costly symmetric filtering), while CONJPSSECOND exhibits normal filtering.[126] Since nothing in the design controls for order effects of negation in conjunctions that do not carry presuppositions, this explanation is fully compatible with the data.

Finally, on the question of whether any triggers diverged from the overall pattern suggested when averaging out across all item (Fig 5.3), figure 5.4 shows that this did not happen. Both *again* and *too* behave alike: in both cases there is a contrast between NEGPSFIRST vs NEGPSSECOND, a contrast between CONJPSFIRST vs CONJPSSECOND, and a contrast between EISIMPLEPS vs SSIMPLEPS.

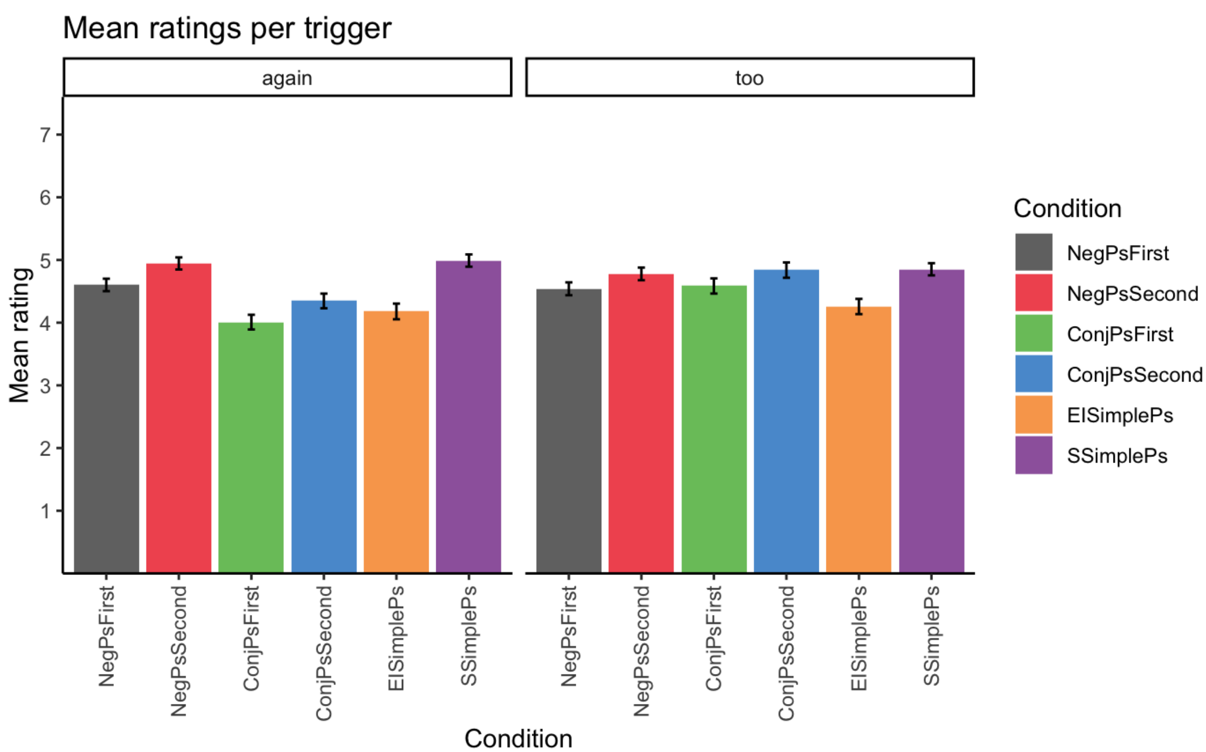

Figure 5.4: Mean acceptability by Trigger (Exp2). Error bars indicate standard error.

[126] Following the same logic, one could try and attribute the contrast between CONJPSFIRST and CONJPSSECOND to an order effect that is independent from presupposition. Given the results in Chapter 2 where ORDER did not appear to play a role in bringing about presupposition-independent contrasts, this seems less likely. However, it is possible in principle.

5.5. General Discussion

Where do we stand after the two experiments reported in this chapter? On the one hand, Experiment 1 found some evidence for the predictions of *System 1*. However, the lack of a control for the effects of local accommodation, as well as the possibility of the effects varying by trigger type prevented a wholesale adoption of that evidence.

Conversely, Experiment 2 attempted to control for the effects of local accommodation and trigger type by including conditions that measured the effects of local accommodation and by focusing on a homogenous sample of triggers. The result was that negated conjunctions showed contrasts parallel to those of unnegated conjunctions, something that is not expected under *System 1*. At the same time, negated conjunctions showed the effects of symmetric filtering in a way that couldn't be fully replicated for unnegated conjunction. Therefore, an account whereby all conjunctions, negated or unnegated, behave the same in terms of projection cannot be adopted on the basis of the current data either. Moreover, the lack of controls for any order-related effects of negation that are independent of presupposition puts another limitation on how much Experiment 2 can help us differentiate between the three systems we considered in section 5.2.

As such, the conservative conclusion is that more work is needed to fully distinguish whether there are any triggers that behave the way *System 1* predicts.[127] Here, I merely want to point to how the design of Experiment 2 can be tweaked in a way that will overcome some of the aforementioned difficulties and will hopefully lead to a clearer picture in the future.

In Experiment 2, the design was changed so that all the Neg/ConjPs conditions appeared in an EI context. This had the advantage of uniformity, but necessitated an order manipulation so as to get a contrast between cases where a presupposition is not supported by material that precedes (Neg/ConjPsFirst) and cases where it is (Neg/ConjPsSecond). However, we saw that this introduced an inadvertent confound whereby order effects related to whether a negation appears

[127] Not to mention the work that will be needed to then distinguish between *System 2* and the dynamic system, should *System 1* turn out to be on the wrong track across the board. However, this extra work might more optimistically be called a research program.

in the first or second conjunct are not controlled for. A straightforward way to avoid that is to go back to the set up of Experiment 1, where there are only NEG/CONJPSFIRST sentences, and what is manipulated is the context, rather than the order of conjuncts. This leads to stimuli like the following:

(34) a. **EI Context:** Mary lives outside the city but likes to visit in order to go to the theater whenever there's a new show, often going twice to every show. The other day, I saw her in the city, shopping close to the theater. I have no idea if she's been to the new show so far, but I thought:

b. **S Context:** Mary lives outside the city but likes to visit in order to go to the theater whenever there's a new show, often going twice to every show. The other day, I saw her in the city, shopping close to the theater. I know that she's been to the new show, although I can't recall if that was this week or the previous week. So, I thought:

c. If it's not the case that Mary is going to the new show again, and it is the case that she went to it last week, then she's just in town for shopping today. NEGPSFIRST

(35) a. **EI Context:** Mary lives outside the city but likes to visit in order to go to the theater whenever there's a new show, often going twice to every show. The other day, I saw her in the city, shopping close to the theater. I have no idea if she's been to the new show so far, but I thought:

b. **S Context:** Mary lives outside the city but likes to visit in order to go to the theater whenever there's a new show, often going twice to every show. The other day, I saw her in the city, shopping close to the theater. I know that she's been to the new show, although I can't recall if that was this week or the previous week. So, I thought:

c. If it's the case that Mary is going to the new show again, and it's the case that she went to it last week, then she isn't just in town for shopping today. CONJPSFIRST

The EI/S-SIMPLEPS conditions will be kept as before in order to control for the effects of local accommodation:

(36) a. **EI Context:** Mary lives outside the city but likes to visit in order to go to the theater whenever there's a new show, often going twice to every show. The other day, I saw her in the city, shopping close to the theater. I have no idea if she's been to the new show so far, but I thought:

b. **S Context:** Mary lives outside the city but likes to visit in order to go to the theater whenever there's a new show, often going twice to every show.The other day, I saw her in the city, shopping close to the theater. I know that she went to the new show once already, so I thought:

c. If it's not the case that Mary is going to the new show again, then she's just in town for shopping today. SIMPLEPS

Any difference now between EINEGPSFIRST vs SNEGPSSECOND can be attributed to the difference in contexts (which would be interpreted as an effect of having to locally accommodate the presupposition). Since both EINEGPSFIRST and SNEGPSSECOND involve a negation in the first conjunct, an effects of the negation coming first should be common to both of them. Similarly, the CONJPS conditions are also freed of any order-related confounds.

Therefore, any difference that we find now between EI-NEGPSFIRST vs S-NEGPSFIRST will be solely attributable to effects of presupposition on the context.[128] Similarly for the CONJPS conditions. We can subsequently test for a CONTXTTYPE $\times$ CONJTYPE interaction as in Experiment 1, and for a PRIORSUP $\times$ ANTTYPE interaction as in Experiment 2.

[128]This holds on the assumption that the change from EI to S will not introduce any infelicities that go beyond the effects of presupposition. In a sense, Experiment 2 avoided this possibility by having the context always be an EI context across the board for the NEG/CONJPS conditions. However, it seems to me that a careful implementation of the EI vs S contrast can avoid spurious infelicities, as long as the only thing that changes is the presence of explicit ignorance, and the rest of the context is kept constant.

5.6. Conclusion

This chapter presented a first attempt to distinguish between three different systems of filtering that were developed in response to the challenge that presupposition filtering in conjunction appears asymmetric, whereas filtering in disjunction appears (costlessly) symmetric. The three systems diverged on the case of conjunctions where the presuppositional first conjunct carried a negation: *System 1* predicted the possibility of costless symmetric filtering there, whereas *System 2* and the dynamic system predicted that the same asymmetry should be present as with unnegated conjunctions.

Two experiments were run in an effort to clarify the issue. The first experiment found support for the predictions of *System 1*, but did not properly control for the effects of local accommodation. The second experiment substantiated one of the predictions of *System 1* (namely that symmetric filtering in negated conjunction is less costly than local accommodation), but at the same time found a contrast of ORDER between negated conjunctions, that was not predicted by *System 1*. Because the potential order effects of negation and presupposition were not separately controlled for in Experiment 2, it was not possible to decide which of the two is responsible for this contrast.

Finally, a modification of the design was suggested that overcomes these confounds. It is to be hoped (fervently) that a future implementation of this modification will shed some light into these complex issues.

Chapter 6

Conclusion

6.1. Summary of main findings

Recall the four main questions we started with in chapter 1:

1. Is there is genuine difference of symmetry between filtering in conjunction vs filtering in disjunction? Or do both connectives exhibit parallel filtering profiles?

2. If conjunction and disjunction indeed differ in terms of their filtering profiles, is there a way of adapting either the pragmatic or the semantic approaches to the problem in a way that predicts this? And what does each approach (in its modified incarnation) have to say about the commutativity of the underlying semantics of connectives?

3. Given a theory of filtering, how can it be extended to apply to coordinations of polar questions?

4. To the extent that both semantic and pragmatic theories of the phenomena are possible, can we isolate cases where their predictions differ, so as to start distinguishing them empirically?

The present dissertation offered the following answers:

1. Conjunction and disjunction are different in their filtering profile. Conjunctions shows a strong preference for asymmetry, while disjunction a strong preference for symmetry.

2. Yes, both pragmatic (*Limited Symmetry*) and semantic (modified dynamics) approaches can be adapted so that they **predict** asymmetric conjunction but symmetric disjunction. Both kinds of approach start with a fully commutative semantics, and then impose constraints to predict the requisite variations in filtering.

3. We extended *System 1* of *Limited Symmetry* to apply to coordinations of polar questions. The core intuition was that comprehenders can reason about positive vs negative answers

to coordinations of polar questions in real time, and this can be plugged into the *Limited Symmetry* formalism in way that is both natural and avoids predicting problematic resolution conditions for such questions.

4. Yes, the different systems of (a-)symmetry we developed in chapter 3 make distinct predictions across a number of cases. We looked into the particularly interesting case of conjunctions with a negated first conjunct in chapter 5. *System 1* predicted symmetric filtering in these cases, while *System 2* and the modified dynamic system predicted garden-variety asymmetry. The two experiments we ran on this, while illuminating the issue and suggesting that the prediction of symmetry might indeed be substantiated for at least some triggers, proved in the end somewhat inconclusive.

6.2. Avenues for future research

In the remainder of this concluding chapter, I would like to point to some avenues for future research that are opened by the results of this dissertation. Largely, these avenues can be divided into experimental and theoretical: the experimental ones involve extending the paradigms we have used in the dissertation to figure out the (a-)symmetries of other constructions. The theoretical ones involve extending the various systems of filtering we have developed to capture more constructions and generate predictions for future experimental testing.

Below, I discuss some obvious next steps that involve (mostly straightforward) extensions of the acceptability-judgment task we have used in the preceding chapters. Along the way, I also point out places for further theoretical development.

6.2.1. Negation

Negated Conjunction The clear loose end that this dissertation leaves open is the issue of negated conjunctions. The two experiments we ran in chapter 5 gave somewhat conflicting results, and neither experiment was fully confound-free.

We indicated a way forward at the end of chapter 5, which involved essentially abandoning the order manipulation we utilized in Experiment 2; instead, we proposed going back to a context-based manipulation, while keeping the conditions required to control for local accommodation.

Negated disjunction At the same time, negated conjunctions are not the only way to use negation to distinguish between the various systems we developed in chapter 3. Negated disjunctions is another way to do the same.

Recall that on *System 1*, a disjunction with a presuppositional first disjunct that is negated is predicted to show asymmetry: the presupposition should project regardless of the second disjunct. Of course, if the negated presuppositional disjunct appears second, then classic filtering patterns apply: if the negation of the first disjunct entails the presupposition, all should be fine.

At the same time, unnegated disjunctions in either order should show the classic symmetric pattern we explored in chapter 2. Therefore, one can import much of the same design logic we developed in chapter 5 to test negated conjunction, in order to test negated disjunctions.

For example, the basic negated disjunction manipulation might look as follows:

(1) a. **EI Context:** Mary lives outside the city but likes to visit in order to go to the theater whenever there's a new show, often going twice to every show. The other day, I saw her in the city, but at that moment, she was shopping close to the theater instead of attending a performance. I have no idea if she's been to the new show so far, so I thought:

b. Either it's not the case that Mary is going to the new show again, or she hasn't been to the new show so far. NegPsFirst

c. Either Mary hasn't been to the new show so far, or it's not the case that she's going to the new show again. NegPsSecond

Note that because this kind of disjunction precludes a Support context (recall the relevant discussion from chapter 2),[129] we cannot use a context-based manipulation in order to contrast cases where

[129] Recall also from chapter 3 that when we embed a negated disjunction in a conditional the predictions change, so using the conditional trick to be able to embed these sentences in a Support context will not work this time.

the presupposition is predicted to project vs filtered. Therefore, we have to use an order-based manipulation, as indicated in (1).

This means that potential order-related confounds (of the kind discussed in chapters 2 and 5) must be controlled for explicitly. This can be done by including NoPs conditions, as we did in chapter 2, where the 'again' is replaced by a non-presuppositional item. Further, the negated cases in (1) must be compared to versions where the negation is removed, in either order (DisjPsFirst vs DisjPsSecond). Finally, a local accommodation condition must be included.

I will not attempt to develop these stimuli here, as I'm merely aiming to give a sense of the overall experiment, but the basic design principles should be clear, as should also be the predictions made: on *System 1* there should be an interaction between DisjType (Neg vs NoNeg) and Order (First vs Second), with the difference between NegPsFirst-NegPsSecond being significantly greater than the different between DisjPsFirst-DisjPsSecond. Moreover, the difference between NegPsFirst-NegPsSecond should be greater than the difference between the corresponding NoPs conditions, as the Ps conditions involve a presupposition, whereas the NoPs conditions do not (again recall the corresponding reasoning from chapter 2). Therefore, an interaction is expected between Ps and Order. Conversely, on *System 2* and the Dynamic system, none of these interactions are expected, as all disjunctions are predicted to be on par. Finally, the local accommodation conditions can be used in the usual way as a baseline for judging the availability of symmetric filtering across all kinds of disjunction.

Linearity effects So far, the cases involving negation that we have considered allow us to distinguish between *System 1* on the one hand vs *System 2* and the dynamic system on the other. If indeed it turns out that at least some triggers do not behave like *System 1* predicts, then it becomes necessary to inquire whether they behave like *System 2* or the dynamic system. A crucial case for settling that will be conjunctions like the following:

(2) It's not the case that John stopped smoking and used to smoke pre-packed cigarettes.

On *System 2* such conjunctions are predicted to show symmetric filtering and project no presupposition, whereas on the dynamic system the presupposition projects.

To design a simple first experimental set-up that will allow us to start testing this, we can import the Mandelkern et al. 2020 design for conjunction (recall chapter 2): we can have an order-based manipulation both for presuppositional and non-presuppositional sentences, as well as a local accommodation manipulation (all presented in explicit ignorance contexts). Schematically, these will look something like the following:

(3)
  a. **EI:** I know that John doesn't like using pre-packaged products, but I have no idea if he has ever smoked. Nevertheless, I know that
  b. It's not the case that John stopped smoking and used to pre-packed cigarettes. PsFirst
  c. It's not the case that John used to smoke pre-packed cigarettes and stopped smoking. PsSecond

(4)
  a. **EI:** I know that John doesn't like using pre-packaged products, but I have no idea if he has ever smoked. Nevertheless, I know that:
  b. It's not the case that John frowns smoking and used to smoke pre-packed cigarettes. NoPsFirst
  c. It's not the case that John used to pre-packed cigarettes and frowns upon smoking. NoPsSecond

(5)
  a. **EI:** I know that John doesn't like using pre-packaged products, but I have no idea if he has ever smoked. Nevertheless, I know that:
  b. **S:** I know that John doesn't like using pre-packaged products. I know that he used to smoke, but I don't know if he still does. Nevertheless, I know that:
  c. If it's not the case that John has stopped smoking, he uses loose, instead of pre-packaged, tobacco. SimplePs

Much like the Mandelkern et al. (2020)-inspired reasoning we deployed in chapter 2, if there is an asymmetry between PsFirst vs PsSecond, we should see an interaction between Ps (Ps vs NoPs) and Order (First vs Second). Correspondingly, no such interaction should exist if PsFirst and PsSecond both allow filtering; indeed PsFrist and PsSecond should be equally acceptable. At the same time, the difference between PsFirst-PsSecond should be greater than the difference between EISimplePs-SSimplePs (since the former pair involves filtering, whereas the latter costly local accommodation).

Of course, this initial set-up would need to be supplemented by an experiment that contrasts this type of conjunction to conjunctions without the negation, since we know unnegated conjunction are asymmetric. There are some non-trivial implementational issues that have to be overcome in designing such a follow-up; the main one has to do with the fact that simple conjunctions cannot be used in EI contexts, so more complicated examples involving conditionals will have to be constructed. But this is a problem for the future.

6.2.2. Conditionals

A corner of the data that has received little experimental attention in this dissertation is the (a-)symmetries of filtering with respect to conditionals. Here, I will simply remind the reader of two core cases reviewed in chapter 3: conditionals with a negated antecedent and antecedent-final conditionals.

Whether antecedent-initial conditionals exhibit symmetry can be tested with a design along the following lines:

(6) a. **EI:** Mary's office has no windows. Thus, whenever it's raining outside, she only becomes aware when the rain is heavy and its noise audible. I don't know if it it's raining today, so I thought:

b. **S:** Mary's office has no windows. Thus, whenever it's raining outside, she only becomes aware when the rain is heavy and the noise its noise audible. It's raining today but I don't know how heavily; so, I thought:

c. If Mary doesn't know that it's raining, then it's not raining heavily. NegCond

d. If Mary knows that it's raining, then it's raining heavily. SimpleCond

The idea here is that that if simple conditionals with a negated antecedent exhibit symmetric effects, then there should be no difference between EINegCond vs SNegCond; both involve support for the presupposition of the antecedent, either through filtering or contextual support. On the other hand, all theories we have focused on in this dissertation predict a difference between EISimpleCond vs SSimpleCond; the former requires recourse to local accommodation, whereas the latter requires nothing. Thus a straightforward interaction is predicted between Context and CondType.[130]

The beautiful aspect of applying this approach to antecedent-initial conditionals, is that the same design can be kept for testing the symmetry of antecedent-final conditionals: just reverse the conditionals!

(7) a. It's not raining heavily, if Mary doesn't know that it's raining. NegCond

b. It's raining heavily, if Mary knows that it's raining. SimpleCond

Recall that *System 1* predicts symmetry for both antecedent-initial and antecedent-final conditionals. *System 2* predicts asymmetry for both kinds, whereas the dynamic system predicts asymmetry for antecedent-initial conditionals, but for antecedent-final conditionals different predictions are made, depending on whether it's **linear order** vs **compositional order** that matters. Therefore, getting data on these two cases will help not only with distinguishing between the three theories of chapter 3, but also with the larger question of whether the filtering mechanism cares about linear or compositional order.

[130]Note that another interesting aspect of this design is that we do not need further conditions to control for local accommodation. No kind of filtering is expected to be available in the SimplPe cases, thus only recourse to local accommodation can prevent the presupposition projecting.

6.2.3. Questions

A pressing empirical question regards the coordinations of polar questions we examined in chapter 4. There, we argued on the basis of intuitive judgments that conjunctions of polar questions show asymmetric filtering, whereas disjunctions show symmetry. It is important to make sure that this is also supported experimentally, by adapting the experiments of chapter 2 to questions. To give a sense of the stimuli that would be involved, consider the following:

(8) (No)ConjPsFirst/Second

a. I wonder whether Mary has stopped raising bees/frowns upon raising bees and whether she used to raise *Apis* bees. (No)ConjPsFirst

b. I wonder whether Mary used to raise *Apis* bees and whether she has stopped raising bees/frowns upon raising bees. (No)ConjPsSecond

(9) (No)DisjPsFirst/Second

a. I wonder whether Mary has stopped raising bees/frowns upon raising bees or whether she never used to raise bees. (No)DisjPsFirst

b. I wonder whether Mary never used to raise bees or whether she has stopped raising bees/frowns upon raising bees. (No)DisjPsSecond

(10) a. I wonder whether Mary has stopped raising bees. SimplePs

The design is fully parallel to Experiment 2 from chapter 2. We are conjoining embedded whether-questions now (the embedding being necessary for reasons presented in 2). We include both orders of conjuncts/disjuncts (First vs Second), in both presuppositional and non-presuppositional versions (Ps vs NoPs), as well as conditions that control for local accommodation (SimplePs). EI and S contexts (omitted here) will be used in much the same way as in previous experiments.

On the theoretical side, an obvious extension would involve adapting *System 2* as well as the dynamic system to coordinations of polar questions, as well as examining the predictions of all three systems in more detail with respect to questions.

6.2.4. Quantifiers

An important (and somewhat vexed) issue is the presupposition projection from the scope of quantifiers. This topic has engendered a lengthy debate, the main question being whether sentences like (11) presuppose that *some of the students used to smoke*, (Beaver, 2001, a.o.), or that *all of the students used to smoke*, (Heim, 1983b; Schlenker, 2009; Barker, 2022), or both.

(11) None/All/Some of my students stopped smoking.

Another dimension is that other quantifiers might exhibit more varied projection patterns (see e.g. Tiemann 2014, Chemla 2009), where the force of the projected presupposition depends on the force of the quantifier. For example, it's plausible that (12) below presupposes that 'most students used to smoke', rather than 'all/some of the students used to smoke':

(12) Most of my students stopped smoking

Extending our experimental paradigm to cases of this sort promises to shed much-needed light into these open questions. Moreover, an interesting theoretical challenge, especially if it turns out that projection from the scope of quantifiers exhibits variability, will be to develop theoretical accounts to capture this variability in a predictive way (see Kalomoiros 2022b for some initial thoughts).

6.2.5. Other kinds of (a-)symmetry

In this dissertation, the focus has been on the (a-)symmetries of presupposition. However, recall from Chapter 1 that the problem of (a-)symmetries is a general one. As such, it would be very interesting to find whether other kinds of (a-)symmetry can vary by connective in the way we have seen that filtering (a-)symmetries do.

An obvious point of comparison are the asymmetries involved in anaphora resolution. Recall an example of asymmetric anaphora resolution in conjunction (cf. the parallel examples in chapter 1):

(13) a. There is a bathroom$_i$ bathroom in this house and it$_i$'s in a weird place.

b. ✗It$_i$'s in a weird place and there is a bathroom$_i$ bathroom in this house.

The following famous example by Barbara Partee shows that the above asymmetry might be alleviated in disjunctions:

(14) a. Either there is a bathroom$_i$ in this house or it$_i$'s in a funny place.

b. ?Either it$_i$'s in a funny place or there isn't a bathroom$_i$ in this house.

We can then ask a question parallel to the one we asked in chapter 2: to what extent is there a genuine difference between conjunction vs disjunction with respect to anaphora resolution?

The results will have significant consequences for theories of anaphora: if we find that indeed there is a genuine difference between the two connectives, with disjunction being more symmetric and conjunction being asymmetric, then we have argument for treating anaphora resolution and presupposition filtering as phenomena that are driven by the same mechanism (and indeed in some cases presupposition and anaphora resolution are identified as essentially the same kind of phenomenon, (Heim, 1983a; van der Sandt, 1992; Rothschild, 2017, a.o.))). On the other hand, if it turns out that after controlling for various potential confounds, conjunction and disjunction can both show costly symmetric anaphora resolution, while asymmetric resolution is the default, then we have an argument for the thesis that presupposition and anaphora actually involve different mechanisms. The theoretical challenge will then become spelling these different mechanisms out in a way that is predictive.

6.3. Closing thoughts

Presupposition is a multi-faceted topic whose story runs long, both in the philosophy of language, (Frege, 1892; Strawson, 1950)) and in semantics/pragmatics, (Langendoen & Savin, 1971; Karttunen, 1973, 1974; Stalnaker, 1974; Karttunen & Peters, 1979; Gazdar, 1979; Soames, 1982; Heim, 1983b; Beaver, 2001; Schlenker, 2008, 2009; Rothschild, 2011; Mandelkern et al., 2020, to give just a few of the references that have been central to the narrative here). In this dissertation, we aimed to contribute to this story by illuminating the way the filtering mechanism interacts with the process of incremental interpretation.

Specifically, we deployed careful experimentation to argue that filtering (a-)symmetries vary by connective. We then proceeded to state rigorously defined theoretical hypotheses that aimed to defend the intuition that (a-)symmetries need not be stipulated, but can be **derived predictively**, by the way a symmetric/commutative semantics interacts with incremental filters.

It is to be hoped that our blend of experimentation and rigorous theory development represents a worthy, empirically grounded response to the Schlenkerian call for predictive theories of filtering, settling some questions while opening up some new ones for the future.

FINIS

APPENDIX A

STIMULI FOR CHAPTER 2 EXPERIMENTS

A.1. Experiment 1

Again

EI Context: My friend William researches the history of music and for the past few years he has been researching the history of woodwinds. One day, I stopped by his house and I saw a book about the cello. I don't know if William ever had research interests in the history of stringed instruments, so I thought:

Either William is getting interested in the history of stringed instruments again, or he never had an interest in stringed instruments and the book is unrelated to his research.

Either William never had an interest in the history of stringed instruments and the book is unrelated to his research, or he is getting interested in stringed instruments again.

Either William is getting interested in the history of stringed instruments, or he never had an interest in stringed instruments and the book is unrelated to his research.

Either William never had an interest in the history of stringed instruments and the book is unrelated to his research, or he is getting interested in stringed instruments.

S Context: My friend William researches the history of music and for the past few years he has been researching the history of woodwinds. One day, I stopped by his house and saw a book about the cello. I know that back in the day he used to be interested in the history of stringed instruments. So, I thought:

If William is getting interested in the history of stringed instruments again, then that's why he's reading this book.

Aware

EI Context: John is travelling around the world and has been planning to pass through Berlin. John never visits Berlin without meeting with his friend Mary, who lives in Berlin. Yesterday, I talked to Mary on the phone and she sounded very excited. I am not sure where John is now, so I thought:

Either Mary is aware that John is in Berlin, or John has not passed through Berlin yet and something else is making her excited.

Either John has not passed through Berlin yet and something else is making Mary excited, or she is aware that John is in Berlin.

Either Mary is sure that John is in Berlin, or John has not passed through Berlin yet and something else is making her excited.

Either John has not passed through Berlin yet and something else is making Mary excited, or she is sure that John is in Berlin.

S Context: John is travelling around the world and has been planning to pass through Berlin. John never visits Berlin without meeting with his friend Mary, who lives in Berlin. Yesterday, I talked to Mary on the phone and she sounded very excited. I know that John is currently in Berlin. So, I thought:

If Mary is aware that John is in Berlin, then that must be why she is excited.

Continue

EI Context: My friend John researches 20th century literature. One day, I stopped by his house and saw a copy of Tolkien's 'The Fellowship of the Ring' lying around. I don't know if John ever had research interests in Tolkien's work. So, I thought:

Either John continues having research interests in Tolkien, or he has never had an interest in Tolkien and the book is unrelated to his research.

Either John has never had an interest in Tolkien and the book is unrelated to his research, or he continues having research interests in Tolkien.

Either John has research interests in Tolkien, or he has never had an interest in Tolkien and the book is unrelated to his research.

Either John has never had an interest in Tolkien and the book is unrelated to his research, or he has research interests in Tolkien.

S Context: My friend John researches 20th century literature. One day, I stopped by his house and saw a copy of Tolkien's 'The Fellowship of the Ring' lying around. I know that John has been researching Tolkien recently, so I thought:

If John continues having research interests in Tolkien, then that's why he is reading 'The Fellowship'.

Find out

EI Context: Adam and Eve have been married for two years. Eve has always suspected Adam of cheating on her with his old girlfriend, Lilith. One day, I saw Adam and Eve arguing in the street. I don't know if Adam ever cheated on Eve, so I thought:

Either Eve found out that Adam is cheating on her, or Adam has had no affair with Lilith and the fight is about something else.

Either Adam has had no affair with Lilith and the fight is about something else, or Eve found out that Adam is cheating on her.

Either Eve is sure that Adam is cheating on her, or Adam has had no affair with Lilith and the fight is about something else.

Either Adam has had no affair with Lilith and the fight is about something else, or Eve is sure that Adam is having an affair.

S Context: Adam and Eve have been married for two years. Eve has always been suspecting

Adam of cheating on her with his old girlfriend, Lilith. I know that Adam in fact has been cheating on Eve with Lilith. So, when one day I saw Adam and Eve arguing in the street, I thought:

If Eve found out that Adam is having an affair with Lilith, then that must be why they are arguing.

Happy

EI Context: Alex has been planning to travel to Edinburgh. Among other things, he wants to see his friend Caroline, who lives there. However, a few days before his flight, Alex fell sick and he told me he wasn't sure that he would be able to travel after all. A couple of days after Alex was supposed to have arrived in Edinburgh, I talked with Caroline on the phone and she sounded very happy. I don't know if Alex managed to travel in the end. So, I thought:

Either Caroline is happy that Alex is in Edinburgh, or Alex has not travelled to Edinburgh yet and something else is making her happy.

Either Alex has not traveled to Edinburgh yet, and something else is making Caroline happy, or she is happy that Alex is in Edinburgh.

Either Caroline thinks that Alex is in Edinburgh, or Alex has not traveled to Edinburgh yet, and something else is making her happy.

Either Alex has not traveled to Edinburgh yet, and something else is making Caroline happy, or she thinks that Alex is in Edinburgh.

S Context: Alex has been planning to travel to Edinburgh. Among other things, he wanted to see his friend Caroline, who lives there. Yesterday, I talked with Caroline on the phone and she sounded very happy. I know that Alex is currently in Edinburgh. So, I thought:

If Caroline is happy that Alex is in Edinburgh, then they must be having a great time.

Stop

EI Context: Me and my engineer friend Stephen were walking past a vape shop the other day.

I noticed Stephen staring intently at the vaping supplies there and I wondered why. I know that Stephen currently does not vape. However, I don't know if Stephen was ever in the habit of vaping. So, I thought:

Either Stephen has recently stopped vaping, or he has never vaped in the past, and he's just staring at the vaping supplies because he is interested in the technology behind e-cigarettes.

Either Stephen has never vaped in the past, and he's just staring at the vaping supplies because he is interested in the technology behind e-cigarettes, or he has recently stopped vaping.

Either Stephen generally frowns upon vaping, or he has never vaped in the past, and he's just staring at the vaping supplies because he is interested in the technology behind e-cigarettes.

Either Stephen has never vaped in the past, and he's staring at the vaping supplies because he is interested in the technology behind e-cigarettes, or he generally frowns upon vaping.

S Context: Me and my engineer friend Stephen were walking past a vape shop the other day, and I saw Stephen staring intently at the vaping supplies there and I wondered why. I know that Stephen has been vaping in the past. So, I thought:

If Stephen has recently stopped vaping, then he must be staring at the vaping supplies because he misses it.

A.2. Experiment 2

A.2.1. Conjunction

A.2.1.1. Critical Items

Stop

i)

EI Context: Jonathan has played various games for a living. Mark is interviewing former bridge players who now dislike card games. I don't know if Jonathan has ever played any card games, so

I thought:

If Jonathan has stopped playing card games and used to play bridge, then Mark might want to talk to him.

If Jonathan used to play bridge and has stopped playing card games, then Mark might want to talk to him.

If Jonathan now frowns upon playing card games and used to play bridge, then Mark might want to talk to him.

If Jonathan used to play bridge and now frowns upon playing card games, then Mark might want to talk to him

EI Context: Jonathan has played various games for a living. Mark is interviewing former bridge players who now dislike card games. I don't know if he has ever played any card games, so I thought:

S Context: Jonathan has played various games for a living. Mark is interviewing former bridge players who now dislike card games. I know that some of the games Jonathan used to play were card games, so I thought:

If Jonathan has stopped playing card games, then Mark might want to talk to him.

ii)

EI Context: I used to raise Apis bees: these sting a lot, and also die when they sting you, which reduces honey production. But a recently discovered genetic mutation can produce bees which have no sting. Cynthia is interested in honey production, but she has reservations about bees dying. It thus surprised me when I discovered that she had not heard about the genetically modified bees. I don't know if she has ever raised any bees, so I thought:

If Cynthia has stopped raising bees, and used to raise Apis bees, then it makes sense that she hasn't heard about this.

If Cynthia used to raise Apis bees, and has stopped raising bees,then it makes sense that she hasn't heard about this.

If Cynthia frowns upon raising bees and used to raise Apis bees, then it makes sense that she hasn't heard about this.

If Cynthia used to raise Apis bees and frowns upon raising bees, then it makes sense that she hasn't heard about this.

EI Context: I used to raise Apis bees: these sting a lot, and die when they sting you, which reduces honey production. But a recently discovered genetic mutation can produce bees which have no sting. Cynthia is interested in honey production, so it surprised me when I discovered that she had not heard about the genetically modified bees. I don't know if she has ever raised any bees, so I thought:

S Context: I used to raise Apis bees: these sting a lot, and die when they sting you, which reduces honey production. But a recently discovered genetic mutation can produce bees which have no sting. Cynthia is interested in honey production, so it surprised me when I discovered that she had not heard about the genetically modified bees. I know that she used to raise bees, but I don't know if she still does. So, I thought:

If Cynthia has stopped raising bees, then it makes sense that she hasn't heard about this.

iii)

EI Context: Fred takes up various hobbies, although occasionally he gives some of them up, worrying that he spends too much time on idle pursuits. I found a nice kit for a ship model, but it's pretty intricate. I don't know if Fred has ever done any ship modeling, so I thought:

If Fred has stopped building ship models and has only built simple models, then this kit will not suit him.

If Fred has only built simple models and has stopped building ship models, then this kit will not suit him.

If Fred frowns upon building ship models and has only built simple models, then this kit will not suit him.

If Fred has only built simple models and frowns upon building ship models, then this kit will not suit him.

EI Context: Fred takes up various hobbies, although occasionally he gives some of them up, worrying that he spends too much time on idle pursuits. I found a nice kit for a ship model, but it's pretty intricate. I don't know if Fred has ever done any ship modeling, so I thought:

S Context: Fred takes up various hobbies, although occasionally he gives some of them up, worrying that he spends too much time on idle pursuits. I found a nice kit for a ship model, but it's pretty intricate. I know that Fred used to build ship models as a teenager, but I have no idea if he still does. So, I thought:

If Fred has stopped building ship models, then this kit will not suit him.

iv)

EI Context: I'm organizing a spelunking trip to a difficult cave. Back in college, Kat had an interest in extreme sports, although I don't know how she feels about the dangers involved in them these days. Also, I have no idea if she ever actually tried spelunking. So, I thought:

If Kat has stopped doing spelunking and has only done spelunking in easy caves, then this trip is not for her.

If Kat has only done spelunking in easy caves and has stopped doing spelunking, then this trip is not for her.

If Kat frowns upon doing spelunking and has only done spelunking in easy caves, then this trip is not for her.

If Kat has only done spelunking in easy caves and frowns upon doing spelunking, then this trip is not for her.

EI Context: I'm organizing a spelunking trip to a difficult cave. Back in college, Kat had an interest in extreme sports, although I don't know how she feels about the dangers involved in them these days. Also, I have no idea if she ever actually tried spelunking. So, I thought:

S Context: I'm organizing a spelunking trip to a difficult cave. Back in college, Kat had an interest in extreme sports, although I don't know how she feels about the dangers involved in them these days. I know that in college she used to go spelunking. So, I thought:

If Kat has stopped doing spelunking, then this trip is not for her.

v)

EI Context: Meredith is a talented woodworker. She has an interest in watercraft, but she's often concerned about safety, especially with wooden ones. I found a book the other day on how to construct wooden dory boats with enhanced safety specifications. I have no idea if Meredith has ever built any kind of wooden boat, so I thought:

If Meredith has stopped building wooden boats and has built wooden dory boats before, then this book might be of interest to her.

If Meredith has built wooden dory boats before and has stopped building wooden boats, then this book might be of interest to her.

If Meredith frowns upon building wooden boats and has built wooden dory boats before, then this book might be of interest to her.

If Meredith has built wooden dory boats before and frowns upon building wooden boats, then this book might be of interest to her.

EI Context: Meredith is a talented woodworker. She has an interest in watercraft, but she's often concerned about safety, especially with wooden ones. I found a book the other day on how to construct wooden boats with enhanced safety specifications. I have no idea if Meredith has ever built any wooden boats, so I thought:

S Context: Meredith is a talented woodworker. She has an interest in watercraft, but she's often concerned about safety, especially with wooden ones. I found a book the other day on how to construct wooden boats with enhanced safety specifications. I know that there was a time when Meredith was building wooden boats, but I don't know if she still does. So, I thought:

If Meredith has stopped building wooden boats, then this book might be of interest to her.

vi)

EI Context: Dave likes trying ambitious activities on his own, although occasionally he gets frustrated and ends up resenting some of them. He has an interest in reading fantasy fiction, so I'm thinking about giving him a step-by-step guide on overcoming the frustrations of writing fiction, with a focus on fantasy. I have no idea if Dave has ever done any kind of writing, so I thought:

If Dave has stopped writing fiction and used to write fantasy fiction, then this book should be right for him.

If Dave used to write fantasy fiction and has stopped writing fiction, then this book should be right for him.

If Dave frowns upon writing fiction and used to write fantasy fiction, then this book should be right for him.

If Dave used to write fantasy fiction and frowns upon writing fiction, then this book should be right for him.

EI Context: Dave likes trying ambitious activities on his own, although occasionally he gets frustrated and ends up resenting some of them. He has an interest in reading fiction, so I'm thinking about giving him a step-by-step guide on overcoming the frustrations of writing fiction. I have no idea if Dave has ever done any kind of writing, so I thought:

S Context: Dave likes trying ambitious activities on his own, although occasionally he gets frustrated and ends up resenting some of them. He has an interest in reading fiction, so I'm thinking about giving him a step-by-step guide on overcoming the frustrations of writing fiction. I know that Dave was writing fiction at some point, but I don't know if he still does. So, I thought:

If Dave has stopped writing fiction, then this book should be right for him.

vii)

EI Context: Gareth is a trained chemist and I know he has an interest in brewing. However, he is often against doing any kind of chemistry at home, as he finds it unsafe. I found a book the other day on a safe procedure for home-brewing beers, with a focus on stouts. I have no idea if Gareth has ever done any kind of home-brewing, so I thought:

If Gareth has stopped home-brewing and used to home-brew stouts, then he should find this book interesting.

If Gareth used to home-brew stouts and has stopped home-brewing, then he should find this book interesting.

If Gareth frowns upon home-brewing beers and used to home-brew stouts, then he should find this book interesting.

If Gareth used to home-brew stouts and frowns upon home-brewing beers, then he should find this book interesting.

EI Context: Gareth is a trained chemist and I know he has an interest in brewing. However, he is often against doing any kind of chemistry at home, as he finds it unsafe. I found a book the other day on a safe procedure for home-brewing beers. I have no idea if Gareth has ever done any kind of home-brewing, so I thought:

S Context: Gareth is a trained chemist and I know he has an interest in brewing. However, he is often against doing any kind of chemistry at home, as he finds it unsafe. I found a book the other day on a safe procedure for home-brewing beers. I know that Gareth used to home-brew, but I don't know if he still does. So, I thought:

If Gareth has stopped home-brewing beer, then he should find this book interesting.

viii)

EI Context: Julie has an interest in languages, and often likes to study dialects of foreign languages. However, she's not always successful which tends to frustrate her. I found an excellent simplified student's edition of Don Quixote, which is written in Castilian Spanish. I have no idea if Julie has ever studied any Spanish, so I thought:

If Julie has stopped studying Spanish, and used to study Castilian Spanish, then this student's edition of Don Quixote is just right for her.

If Julie used to study Castilian Spanish and has stopped studying Spanish, then this student's edition of Don Quixote is just right for her.

If Julie frowns upon studying Spanish and used to study Castilian Spanish, then this student's edition of Don Quixote is just right for her.

If Julie used to study Castilian Spanish and frowns upon studying Spanish, then this student's edition of Don Quixote is just right for her.

EI Context: Julie has an interest in learning languages. However, she's not always successful which often frustrates her. I found an excellent student's edition of Don Quixote in Spanish. I have no idea if Julie has ever studied any Spanish, so I thought:

S Context: Julie has an interest in learning languages. However, she's not always successful which often frustrates her. I found an excellent student's edition of Don Quixote in Spanish. I know that Julie studied some Spanish at some point, but I don't know if she still does. So I thought:

If Julie has stopped studying Spanish, then this edition of Don Quixote is just right for her.

Continue

i)

EI Context: The local music school is offering scholarships to students who have been playing the electric guitar for at least a year and want to become more advanced. Emily has musical interests, but I have no idea if she has ever played the electric guitar. So, I thought:

If Emily continues playing the electric guitar and has played it for at least a year, then she should look into applying for the scholarship.

If Emily has played the electric guitar for at least a year and continues playing it, then she should look into applying for the scholarship.

If Emily likes playing the electric guitar and has played it for at least a year, then she should look into applying for the scholarship.

If Emily has played the electric guitar for over a year and likes playing it, then she should look into applying for the scholarship.

EI Context: The local music school is offering scholarships to students who have been playing the electric guitar for some time and want to take the next step. Emily has musical interests, but I have no idea if she has ever played the electric guitar. So, I thought:

S Context: The local music school is offering scholarships to students who have been playing the electric guitar for some time and want to take the next step. Emily has musical interests, and I know that she was playing the electric guitar at some point. So, I thought:

If Emily continues playing the electric guitar, then she should look into applying for the scholarship.

ii)

EI Context: There's a new yoga center in town, which focuses on Jivamukti yoga; it's looking for students who have done Jivamukti yoga for at least three months and want to do more. Mark is interested in wellness activities, although I have no idea if he has ever done Jivamukti yoga. So, I thought:

If Mark continues doing Jivamukti yoga and has done it for at least three months, then they'll be delighted to have him at the new yoga center.

If Mark has done Jivamukti yoga for at least three months and he continues doing it, they'll be delighted to have him at the new yoga center.

If Mark likes doing Jivamukti yoga and has done it for at least three months, then they'll be delighted to have him at the new yoga center.

If Mark has done Jivamukti yoga for at least three months and likes doing it, then they'll be delighted to have him at the new yoga center.

EI Context: There's a new yoga center in town, which focuses on Jivamukti yoga; it's looking for students who have some Jivamukti yoga experience and want to do more. Mark is interested in wellness activities, although I have no idea if he has ever done Jivamukti yoga. So, I thought:

S Context: There's a new yoga center in town, which focuses on Jivamukti yoga; it's looking for students who have some Jivamukti yoga experience and want to do more. Mark is interested in wellness activities, and he has experience with Jivamukti yoga. So, I thought:

If Mark continues doing Jivamukti yoga, then they'll be delighted to have him at the new yoga center.

iii)

EI Context: Liz is a woodworker. Recently, I found a client who owns a wooden speedboat that needs repairs. This is a great project, but requires experience repairing wooden boats, particularly speedboats. I have no idea if Liz has ever done any wooden boat repair, so I thought:

If Liz continues repairing wooden boats and has repaired wooden speedboats before, then she might want to look into this opportunity.

If Liz has repaired wooden speedboats before and continues repairing wooden boats, then she might want to look into this opportunity.

If Liz likes repairing wooden boats and has repaired wooden speedboats before, then she might want to look into this opportunity.

If Liz has repaired wooden speedboats before and likes repairing wooden boats, then she might want to look into this opportunity.

EI Context: Liz is a woodworker. Recently, I found a client who owns a wooden boat that needs repairs. This is a great project but requires experience repairing wooden boats. I have no idea if Liz has ever done any wooden boat repair, so I thought:

S Context: Liz is a woodworker. Recently, I found a client who owns a wooden boat that needs repairs. This is a great project but requires experience repairing wooden boats. I know that Liz used to repair wooden boats when she started out, but I have no idea if she still does. So, I thought:

If Liz continues repairing wooden boats, then she might want to look into this opportunity.

iv)

EI Context: Emily is doing a documentary on the 2008 financial crisis and wants to interview people still into stock-trading who experienced it. I know that Arthur is an investor, but I have no idea if he ever traded in the stock exchange. So, I thought:

If Arthur continues trading at the stock exchange and was trading stocks during the '08 crisis, then Emily might want to talk to him.

If Arthur was trading stocks during the '08 crisis and continues trading at the stock exchange, then Emily might want to talk to him.

If Arthur likes trading at the stock exchange and was trading stocks during the '08 crisis, then Emily might want to talk to him.

If Arthur was trading stocks during the '08 crisis and likes trading at the stock exchange, then Emily might want to talk to him.

EI Context: Emily is doing a documentary on the 2008 financial crisis and wants to interview people still into stock-trading who experienced it. I know that Arthur is an investor, but I have no idea if he ever traded at the stock exchange. So, I thought:

S Context: Emily is doing a documentary on the 2008 financial crisis and wants to interview people still into stock-trading who experienced it. I know that Arthur was trading at the stock exchange during the '08 crisis, but I don't know if he still does. So, I thought:

If Arthur continues trading at the stock exchange, then Emily might want to talk to him.

v)

EI Context: Andrea is interested in water-related activities. I found a book about fishing, which focuses particularly on the types of bait that attract trout. I have no idea if Andrea has ever fished before, so I thought:

If Andrea continues fishing and has fished trout before, then she should find this book interesting.

If Andrea has fished trout before and continues fishing, then she should find this book interesting.

If Andrea likes fishing and has fished trout before, then she should find this book interesting.

If Andrea has fished trout before and likes fishing, then she should find this book interesting.

EI Context: Andrea is interested in water activities. I found a book about fishing, which focuses particularly on the types of bait that attract trout. I have no idea if Andrea has ever fished before, so I thought:

S Context: Andrea is interested in water activities. I found a book about fishing, which focuses particularly on the types of bait that attract trout. I know that Andrea used to fish, although I don't know if she still does. So, I thought:

If Andrea continues fishing, then she should find this book interesting.

vi)

EI Context: Carl is interested in small aircraft. For his birthday, I'm thinking of gifting him a short course on the basics of flying 2-seat planes at night. However, the course requires a minimum of prior familiarity with single-seat planes. I have no idea if Carl has ever piloted any kind of small aircraft, so I thought:

If Carl continues piloting small aircraft and has piloted a single-seat plane before, then he should find this course exciting.

If Carl has piloted a single-seat plane before and continues piloting small aircraft, then he should find this course exciting.

If Carl likes piloting small aircraft and has piloted a single-seat plane before, then he should find this course exciting.

If Carl has piloted a single-seat plane before and likes piloting small aircraft, then he should find this course exciting.

EI Context: Carl is interested in small aircraft. For his birthday, I'm thinking of gifting him a short course on the basics of flying 2-seat planes at night. However, the course requires some prior familiarity with small aircraft. I have no idea if Carl has ever piloted any kind of small aircraft, so I thought:

S Context: Carl is interested in small aircraft. For his birthday, I'm thinking of gifting him a short course on the basics of flying 2-seat planes at night. However, the course requires some prior familiarity with small aircraft. I know that Carl used to fly single seat planes, so I thought:

If Carl continues piloting small aircraft, then he should find this course exciting.

vii)

EI Context: Johanna has an interest in art, and she particularly appreciates landscapes. I found a book that goes deep into techniques about drawing landscapes, although it requires some familiarity with drawing charcoal landscapes. I have no idea if Johanna has ever drawn any kind of landscape. So, I thought:

If Johanna continues drawing landscapes and has drawn charcoal landscapes before, then this book should be of interest to her.

If Johanna has drawn charcoal landscapes before and continues drawing landscapes, then this book should be of interest to her.

If Johanna likes drawing landscapes and has drawn charcoal landscapes before, then this book should be of interest to her.

If Johanna has drawn charcoal landscapes before and likes drawing landscapes, then this book should be of interest to her.

EI Context: Johanna has an interest in art, and she particularly enjoys landscape paintings. I found a book that goes deep into techniques about drawing landscapes but requires some prior experience. I have no idea if Johanna has ever drawn any kind of landscape. So, I thought:

S Context: Johanna has an interest in art, and she particularly enjoys landscape paintings. I found a book that goes deep into techniques about drawing landscapes but requires some prior experience. I know that Johanna used to draw landscapes, but I don't know if she still does. So, I thought:

If Johanna continues drawing landscapes, then this book should be of interest to her.

viii)

EI Context: Yosiane is interested in water sports. I heard that there's a rowing team down at the river and they're offering courses to beginners who have some prior experience rowing in a team. I have no idea if Yosiane has done any kind of rowing before, so I thought:

If Yosiane continues rowing and has rowed as part of a team before, then she should find the courses interesting.

If Yosiane has rowed as part of a team before and continues rowing, then she should find the courses interesting.

If Yosiane likes rowing and has rowed as part of a team before, then she should find the courses interesting.

If Yosiane has rowed as part of a team before and she likes rowing, then she should find the courses interesting.

EI Context: Yosiane is interested in water sports. I heard that there's a rowing team down at the river and they're offering courses to beginners who have some prior experience. I have no idea if Yosiane has done any kind of rowing before, so I thought:

S Context: Yosiane is interested in water sports. I heard that there's a rowing team down at the river and they're offering courses to beginners who have some prior experience. I know that Yosiane has done some rowing before, so I thought:

If Yosiane continues rowing, then she should find the courses interesting.

Again

i)

EI Context: There's a new show at the theater. I want to go tomorrow, but it's quite pricey. Nonetheless, if you have a subscription and you go to the opening night of a performance, then you can go a second time and take someone with you for free. Mary has a subscription, but I don't know if she went to the opening night of this new show. So, I thought:

If Mary is going to the show again and went to the show's opening night, then maybe we could go together.

If Mary went to the show's opening night and is going to the show again, then maybe we could go together.

If Mary went to the show's opening night and is going to the show tomorrow, then maybe we could go together.

If Mary is going to the show tomorrow and went to the show's opening night, then maybe we could go together.

EI Context: There's a new show at the theater. I want to go tomorrow, but it's quite pricey. Nonetheless, if you have a subscription and you go to a performance once, then you can go a second time and take someone with you for free. Mary has a subscription, but I don't know if she has been to any performance of this new show. So, I thought:

S Context: There's a new show at the theater. I want to go tomorrow, but it's quite pricey. Nonetheless, if you have a subscription and you go to a performance once, then you can go a second time and take someone with you for free. Mary has a subscription, and I know that she went to a performance of this new show last week. So, I thought:

If Mary is going to the show again, then maybe we can go together.

ii)

EI Context: Richard is traveling tomorrow and is renting a car at the airport. Avis is offering a deal: if you have rented a luxury car from them before, then you get a discount. I have no idea if Richard has ever rented a car from Avis, so I thought:

If Richard is renting a car from Avis again, and he's rented a luxury car from them before, then he can get a good deal.

If Richard has rented a luxury car from Avis before, and he's renting a car from them again, then he can get a good deal.

If Richard is renting a car from Avis tomorrow, and he's rented a luxury car from them before, then he can get a good deal.

If Richard has rented a luxury car from Avis before, and he's renting a car from them tomorrow, then he can get a good deal.

EI Context: Richard is traveling tomorrow and is renting a car at the airport. Avis is offering a deal: if you have rented a car from them in the past, then you get a 25% discount. I have no idea if Richard has ever rented a car from Avis, so I thought:

S Context: Richard is traveling tomorrow and is renting a car at the airport. Avis is offering a deal: if you have rented a car from them in the past, then you get a 25% discount. I know Richard has rented a car from Avis in the past, so I thought:

If Richard is renting a car from Avis again, then he can get a good deal.

iii)

EI Context: I heard that Karl might be planning a mountain climbing trip, and is thinking of booking it through my company. We specialize in summer mountain climbing trips, and they are always geared towards the more experienced crowd. I have no idea if Karl has ever tried mountain climbing before, so I thought:

If Karl is going mountain climbing again and has climbed smaller mountains before, then booking through my company is the right choice.

If Karl has climbed smaller mountains before and is going mountain climbing again, then booking through my company is the right choice.

If Karl is going mountain climbing this summer and has climbed smaller mountains before, then booking through my company is the right choice.

If Karl has climbed smaller mountains before and is going mountain climbing this summer, then booking through my company is the right choice.

EI Context: Karl is planning a trip, and is thinking about booking through my travel agency. We specialize in mountain climbing trips that are always geared towards the more experienced crowd. I have no idea if Karl has ever tried mountain climbing before, so I thought:

S Context: Karl is planning a trip, and is thinking about booking through my travel agency. We specialize in mountain climbing trips that are always geared towards the more experienced crowd. I know that Karl has climbed quite a bit before, so I thought:

If Karl is going mountain climbing again, then booking through my company is the right choice.

iv)

EI Context: There is a Stradivarius exhibit in town, showcasing many famous violins of great historical value. However, the presentation caters mostly to experts on string instruments. I went to it the other day, and saw David there - a historian of musical instruments with notable work on woodwinds. I have no idea if he has ever researched string instruments, so I thought:

If David is researching string instruments again and has researched violins before, then there are definitely things here that will attract his interest.

If David has researched violins before and is researching string instruments again, then there are definitely things here that will attract his interest.

If David is researching string instruments these days and has researched violins before, then there are definitely things here that will attract his interest.

If David has researched violins before and is researching string instruments these days, then there are definitely things here that will attract his interest.

EI Context: There is a Stradivarius exhibit in town, showcasing many famous violins of great historical value. However, the presentation caters mostly to experts on string instruments. I went to it the other day, and saw David there - a historian of musical instruments with notable work on woodwinds. I have no idea if he has ever researched string instruments, so, I thought:

S Context: There is a Stradivarius exhibit in town, showcasing many famous violins of great historical value. However, the presentation caters mostly to experts on string instruments. I went to it the other day, and saw David there - a historian of musical instruments with notable work on woodwinds. I know that many years ago he was researching string instruments. So, I thought:

If David is researching string instruments again, then there are definitely things here that will attract his interest.

v)

EI Context: The British museum offers various subscription packages. The best subscriptions to start with are the "Ancient World" and "Renaissance" subscriptions, which together allow access to all of the famous exhibits. I heard that Anne might be interested in a British museum subscription, but I have no idea if she ever had one before. So, I thought:

If Anne is buying a subscription for the British museum again and had bought the "Renaissance" subscription before, then she should check out the "Ancient World" subscription.

If Anne had bought the "Renaissance" subscription before and is buying a subscription for the British museum again, then she should check out the "Ancient World" subscription.

If Anne is buying a subscription for the British museum this year and had bought the "Renaissance" subscription before, then she should check out the "Ancient World" subscription.

If Anne has bought the "Ancient Egypt" subscription before and is buying a subscription for the British museum this year, then she should buy the "Ancient World" subscription.

EI Context: The British museum offers various subscription packages: some focus on the Ancient Egypt exhibits, others on Ancient Greece etc. Current discount offers make the ones on Ancient Egypt and Ancient Greece the best deal. I heard that Anne might be interested in a British museum subscription, but I have no idea if she ever had one before. So, I thought:

S Context: The British museum offers various subscription packages: some focus on the Ancient Egypt exhibits, others on Ancient Greece etc. Current discount offers make the ones on Ancient Egypt and Ancient Greece the best deal. I know that Anne had a British Museum subscription once before, but I don't know which one. So, I thought:

If Anne is buying a subscription for the British museum again, she should get one of the subscriptions currently on special offer.

vi)

EI Context: I heard that George might be taking driving lessons for a commercial class A license to drive tractor-trailers. I found a book on tips for class A vehicles, but it requires knowledge of driving class B type vehicles (heavy single vehicle trucks). I have no idea if George has ever taken driving lessons for any kind of vehicle, so I thought:

If George is taking driving lessons again and has taken lessons for a class B type vehicle before, then this book should prove a good resource.

If George has taken lessons for a class B type vehicle before and is taking driving lessons again, then this book should prove a good resource.

If George is taking driving lessons currently and has taken lessons for a B1 type vehicle before, then this book should prove a useful resource.

If George has taken lessons for a B1 type vehicle before and is taking driving lessons currently, then this book should prove a useful resource.

EI Context: I heard that George wants to take driving lessons for a commercial class A license to drive tractor-trailers. I found a book on tips for class A vehicles, but it requires knowledge of driving class B type vehicles (heavy single vehicle trucks). I have no idea if George has ever taken driving lessons for any kind of vehicle, so I thought:

S Context: I heard that George wants to take driving lessons for a commercial class A license to drive tractor-trailers. I found a book on tips for class A vehicles, but it requires knowledge of driving class B type vehicles (heavy single vehicle trucks). I know that George has taken some class B driving lessons before, so I thought:

If George is taking driving lessons again, then this book might be a useful resource.

vii)

EI Context: Alfred recently left his job as an engineer. The other day I saw him wearing a uniform with navy insignia. He has always had a fascination with the military, but I have no idea if he ever served. So, I thought:

If Alfred is serving in the military again and served in the navy before, then that's why he's wearing this uniform.

If Alfred served in the navy before and is serving in the military again, then that's why he's wearing this uniform.

EI Context: I heard that Alfred may have changed careers recently. The other day I saw him wearing a drill sergeant uniform with navy insignia. He has always had a fascination with the military, but I have no idea if he ever served. So, I thought:

If Alfred is serving in the military now as a drill sergeant and has served in the navy before, then that's why he's wearing this uniform.

If Alfred served in the navy before and is serving in the military now, then that's why he's wearing this uniform.

EI Context: I heard that Alfred may have changed careers recently. The other day I saw him wearing a drill sergeant's uniform. Drill sergeants usually have prior military experience, but I have no idea if Alfred ever served in the military. So, I thought:

S Context: I heard that Alfred may have changed careers recently. The other day I saw him wearing a drill sergeant's uniform. Drill sergeants usually have prior military experience. I know that Alfred served in the military when he was younger, so I thought:

If Alfred is serving in the military again, then that's why he's wearing this uniform.

viii)

EI Context: I heard that Elizabeth might be traveling to the Arctic circle. I found a book aimed at people who have some experience traveling in the higher Arctic regions, and want to explore the more inaccessible bits. I have no idea if Elizabeth has ever been to the Arctic circle before, so I thought:

If Elizabeth is going to the Arctic circle again and has been to the higher Arctic regions before, then she will appreciate the value of having this book.

If Elizabeth has been to the higher Arctic regions before and is going to the Arctic circle again, then she will appreciate the value of having this book.

EI Context: I heard that Elizabeth might be traveling to the higher regions of the Arctic circle. I found a book aimed at people who have been to these higher regions before, but are attempting the trip during winter-time (which comes with special challeges). I have no idea if Elizabeth has ever been to the Arctic circle before, so I thought:

If Elizabeth is going to the Arctic circle in the winter and has been to the higher Arctic regions before, then she will appreciate the value of having this book.

If Elizabeth has been to the higher Arctic regions before and is going to the Arctic circle in the winter, then she will appreciate the value of having this book.

EI Context: I heard that Elizabeth might be traveling to the Arctic circle in the winter. I found a book aimed at people who have some experience traveling in the Arctic regions, and want to explore the more inaccessible bits. I have no idea if Elizabeth has ever been to the Arctic circle before, so I thought:

S Context: I heard that Elizabeth might be traveling to the Arctic circle in the winter. I found a book aimed at people who have some experience traveling in the Arctic regions, and want to explore the more inaccessible bits. I know that Elizabeth has been to the Arctic circle before, so I thought:

If Elizabeth is going to the Arctic circle again, then she will appreciate the value of having this book.

A.2.2. Disjunction

A.2.2.1. Critical Items

Stop

i)

EI Context: Mark is writing a book about the ills of card games. He needs to interview former professional card players who now dislike card games, as well as professional players of other kinds of games, who have never played card games and can offer an outsider's perspective. Jonathan has played various games professionally, but I have no idea if he has ever played any card games, so I thought:

If Jonathan either has stopped playing card games or has never played any card games in his life, then Mark might want to talk to him.

If Jonathan either has never played any card games in his life or has stopped playing card games, then Mark might want to talk to him.

If Jonathan either frowns upon playing card games or has never played any card games in his life, then Mark might want to talk to him.

If Jonathan either has never played any card games in his life, or frowns upon playing card games, then Mark might want to talk to him.

EI Context: Mark is interviewing former card players who now dislike card games. Jonathan has played various games for a living, but I don't know if he has ever played any card games. So, I thought:

S Context: Jonathan has played various games for a living. Mark is interviewing former card players who now dislike card games. I know that Jonathan used to play card games, but I don't know which ones. So, I thought:

If Jonathan has stopped playing card games, then Mark might want to talk to him.

ii)

EI Context: I used to raise Apis bees: these sting a lot, and die when they sting you, which reduces honey production. But a recently discovered genetic mutation can produce bees which have no sting. Cynthia is interested in honey production, but she has reservations about bees dying. It thus surprised me when I discovered that she had not heard about the genetically modified bees. I don't know if she has ever raised any bees, so I thought:

If Cynthia either has stopped raising bees or has never raised any bees, then it makes sense that she hasn't heard about this.

If Cynthia either has never raised any bees or has stopped raising bees, then it makes sense that she hasn't heard about this.

If Cynthia either frowns upon raising bees or has never raised any bees, then it makes sense that she hasn't heard about this.

If Cynthia either has never raised any bees or frowns upon raising bees, then it makes sense that she hasn't heard about this.

EI Context: I used to raise Apis bees: these sting a lot, and die when they sting you, which reduces honey production. But a recently discovered genetic mutation can produce bees which have no sting. Cynthia is interested in honey production, so it surprised me when I discovered that she had not heard about the genetically modified bees. I don't know if she has ever raised any bees, so I thought:

S Context: I used to raise Apis bees: these sting a lot, and die when they sting you, which reduces honey production. But a recently discovered genetic mutation can produce bees which have no sting. Cynthia is interested in honey production, so it surprised me when I discovered that she had not heard about the genetically modified bees. I know that she used to raise bees, but I don't know if she still does. So, I thought:

If Cynthia has stopped raising bees, then it makes sense that she hasn't heard about this.

iii)

EI Context: Fred takes up various hobbies, although occasionally he gives some of them up, worrying that he spends too much time on idle pursuits. I found a nice kit for a ship model, but it's pretty intricate. I don't know if Fred has ever done any ship modeling, so I thought:

If Fred has either stopped building ship models or has never built any ship models, then this kit will not suit him.

If Fred either has never built any ship models or has stopped building ship models, then this kit will not suit him.

If Fred either frowns upon building ship models or has never built any ship models, then this kit will not suit him.

If Fred either has never built any ship models or frowns upon building ship models, then this kit will not suit him.

EI Context: Fred takes up various hobbies, although occasionally he gives some of them up, worrying that he spends too much time on idle pursuits. I found a nice kit for a ship model, but it's pretty intricate. I don't know if Fred has ever done any ship modeling, so I thought:

S Context: Fred takes up various hobbies, although occasionally he gives some of them up, worrying that he spends too much time on idle pursuits. I found a nice kit for a ship model, but it's pretty intricate. I know that Fred used to build ship models as a teenager, but I have no idea if he still does. So, I thought:

If Fred has stopped building ship models, then this kit will not suit him.

iv)

EI Context: I'm organizing a spelunking trip to a difficult cave. Back in college, Kat had an interest in extreme sports, although I don't know how she feels about the dangers involved in them these days. Also, I have no idea if she ever actually tried spelunking. So, I thought:

If Kat either has stopped doing spelunking or has never done any kind of spelunking, then this trip is not for her.

If Kat either has never done any kind of spelunking or has stopped doing spelunking, then this trip is not for her.

If Kat either frowns upon doing spelunking or has never done any kind of spelunking, then this trip is not for her.

If Kat either has never done any kind of spelunking, or frowns upon doing spelunking then this trip is not for her.

EI Context: I'm organizing a spelunking trip to a difficult cave. Back in college, Kat had an interest in extreme sports, although I don't know how she feels about the dangers involved in them these days. Also, I have no idea if she ever actually tried spelunking. So, I thought:

S Context: I'm organizing a spelunking trip to a difficult cave. Back in college, Kat had an interest in extreme sports, although I don't know how she feels about the dangers involved in them these days. I know that in college she often used to go spelunking. So, I thought:

If Kat has stopped doing spelunking, then this trip is not for her.

v)

EI Context: Meredith is a talented woodworker. She has an interest in watercraft, but she's often concerned about safety, especially with wooden ones. I found a book the other day on how to construct wooden boats with enhanced safety specifications. It's aimed both at people who want an introduction to building wooden boats, and people who have some experience but need to refresh their knowledge. I have no idea if Meredith has ever built a wooden boat, so I thought:

If Meredith either has stopped building wooden boats or has never built any wooden boats before, then this book might be of interest to her.

If Meredith either has never built any wooden boats before or has stopped building wooden boats, then this book might be of interest to her.

If Meredith either frowns upon building wooden boats or has never built any wooden boats before, then this book might be of interest to her.

If Meredith either has never built any wooden boats before or frowns upon building wooden boats, then this book might be of interest to her.

EI Context: Meredith is a talented woodworker. She has an interest in watercraft, but she's often concerned about safety, especially with wooden ones. I found a book the other day on how to construct wooden boats with enhanced safety specifications. I have no idea if Meredith has ever built any wooden boats, so I thought:

S Context: Meredith is a talented woodworker. She has an interest in watercraft, but she's often concerned about safety, especially with wooden ones. I found a book the other day on how to construct wooden boats with enhanced safety specifications. I know that there was a time when

Meredith was building wooden boats, but I don't know if she still does. So, I thought:

If Meredith has stopped building wooden boats, then this book might be of interest to her.

vi)

EI Context: Dave takes up various activities, although occasionally he gets frustrated and ends up giving some of them up. He has an interest in reading fiction, so I decided to gift him a book on writing fiction. It's good for both absolute beginners, but also for people who have done some writing in the past but gave up in exasperation. I have no idea whether Dave ever tried his hand at writing any fiction, so I thought:

If Dave either has stopped writing fiction or has never written any fiction, then this book should be right for him.

If Dave either has never written any fiction or has stopped writing fiction, then this book should be right for him.

If Dave either frowns writing fiction or has never written any fiction, then this book should be right for him.

If Dave either has never written any fiction or frowns upon writing fiction, then this book should be right for him.

EI Context: Dave likes trying ambitious activities on his own, although occasionally he gets frustrated and ends up resenting some of them. He has an interest in reading fiction, so I'm thinking about giving him a step-by-step guide on overcoming the frustrations of writing fiction. I have no idea if Dave has ever done any kind of writing, so I thought:

S Context: Dave likes trying ambitious activities on his own, although occasionally he gets frustrated and ends up resenting some of them. He has an interest in reading fiction, so I'm thinking about giving him a step-by-step guide on overcoming the frustrations of writing fiction. I know that Dave was writing fiction at some point, but I don't know if he still does. So, I thought:

If Dave has stopped writing fiction, then this book should be right for him.

vii)

EI Context: Gareth is a trained chemist and I know he has an interest in brewing. However, he is often against doing any kind of chemistry at home, as he finds it unsafe. I found a book the other day on a safe procedure for home-brewing beers: it is aimed both towards people who have done some home-brewing but have stalled, and towards first-time home-brewers. I have no idea if Gareth has ever brewed beer before, so I thought:

If Gareth either has stopped home-brewing beer or has never home-brewed beer before, then he should find this book interesting.

If Gareth either has never home-brewed beer before or has stopped home-brewing beer, then he should find this book interesting.

If Gareth either frowns upon home-brewing beer or has never home-brewed beer before, then he should find this book interesting.

If Gareth either has never home-brewed before or frowns upon home-brewing beer, then he should find this book interesting.

EI Context: Gareth is a trained chemist and I know he has an interest in brewing. However, he is often against doing any kind of chemistry at home, as he finds it unsafe. I found a book the other day on a safe procedure for home-brewing beers. I have no idea if Gareth has ever done any kind of home-brewing, so I thought:

S Context: Gareth is a trained chemist and I know he has an interest in brewing. However, he is often against doing any kind of chemistry at home, as he finds it unsafe. I found a book the other day on a safe procedure for home-brewing beers. I know that Gareth used to home-brew, but I don't know if he still does. So, I thought:

If Gareth has stopped home-brewing beer, then he should find this book interesting.

viii)

EI Context: Julie has an interest in learning languages. However, she's not always successful which often frustrates her. I found an excellent simplified student's edition of Don Quixote, in the original Spanish. It offers a comprehensive course in the language, aimed at both people who have some knowledge, but haven't pursued it further, and at absolute beginners. I have no idea if Julie has ever studied any Spanish, so I thought:

If Julie has either stopped studying Spanish or has never studied any Spanish before, then this edition of Don Quixote is just right for her.

If Julie has either never studied any Spanish before or has stopped studying Spanish, then this edition of Don Quixote is just right for her.

If Julie either frowns upon studying Spanish or has never studied any Spanish before, then this edition of Don Quixote is just right for her.

If Julie either has never studied any Spanish before or frowns upon studying Spanish, then this edition of Don Quixote is just right for her.

EI Context: Julie has an interest in learning languages. However, she's not always successful which often frustrates her. I found an excellent student's edition of Don Quixote in Spanish. I have no idea if Julie has ever studied any Spanish, so I thought:

S Context: Julie has an interest in learning languages. However, she's not always successful which often frustrates her. I found an excellent student's edition of Don Quixote in Spanish. I know that Julie studied some Spanish at some point, but I don't know if she still does. So I thought:

If Julie has stopped studying Spanish, then this edition of Don Quixote is just right for her.

Continue

i)

EI Context: The local music school is offering two types of electric guitar scholarships: one is aimed at people who have been playing for some time and want to take the next step; the other is aimed at absolute beginners. Emily has musical interests, and she's looking for a music scholarship. However, I have no idea if she has ever played the electric guitar. So, I thought:

If Emily either continues playing the electric guitar or has never played it in her life, then she should look into applying for the scholarship.

If Emily either has never played the electric guitar in her life, or continues playing it, then she should look into applying for the scholarship.

If Emily either likes playing the electric guitar or has never played it in her life, then she should look into applying for the scholarship.

If Emily either has never played the electric guitar in her life or likes playing it, then she should look into applying for the scholarship.

EI Context: The local music school is offering scholarships to students who have been playing the electric guitar for some time and want to take the next step. Emily has musical interests, but I have no idea if she has ever played the electric guitar. So, I thought:

S Context: The local music school is offering scholarships to students who have been playing the electric guitar for some time and want to take the next step. Emily has musical interests, and I know that she was playing the electric guitar at some point. So, I thought:

If Emily continues playing the electric guitar, then she should look into applying for the scholarship.

ii)

EI Context: There's a new Jivamukti yoga center in town; it's aimed towards people who either have never done any Jivamukti yoga, or who already have substantial Jivamukti yoga experience and want to take more classes. Mark is interested in wellness activities, although I have no idea if he has ever done any Jivamukti yoga. So, I thought:

If Mark either continues doing Jivamukti yoga or has never done it before, then they'll be delighted to have him at the new yoga center.

If Mark either has never done any Jivamukti yoga before or continues doing it, then they'll be delighted to have him at the new yoga center.

If Mark either likes doing Jivamukti yoga or has never done it before, then they'll be delighted to have him at the new yoga center.

If Mark either has never done any Jivamukti yoga before or likes doing it, then they'll be delighted to have him at the new yoga center.

EI Context: There's a new Jivamukti yoga center in town: it wants students with at least some Jivamukti yoga experience. Mark is interested in wellness activities, although I have no idea if he has ever done any Jivamukti yoga. So, I thought:

S Context: There's a new Jivamukti yoga center in town: it wants students with at least some Jivamukti yoga experience. Mark is interested in wellness activities, and he has experience with Jivamukti yoga. So, I thought:

If Mark continues doing Jivamukti yoga, then they'll be delighted to have him at the new yoga center.

iii)

EI Context: Liz is a woodworker. Recently, I found a client who owns a wooden boat that requires minimal repairs. This is a great project for someone who has never done this kind of work before; it's also easy money for someone who's more experienced. I know that Liz has an interest in wooden boats, but I have no idea if she has ever done any wooden boat repair. So, I thought:

If Liz either continues repairing wooden boats or has never repaired any wooden boats before, then she might want to look into this opportunity.

If Liz either has never repaired any wooden boats before or continues repairing wooden boats, then she might want to look into this opportunity.

If Liz either likes repairing wooden boats or has never repaired any wooden boats before, then she might want to look into this opportunity.

If Liz either has never repaired any wooden boats before or likes repairing wooden boats, then she might want to look into this opportunity.

EI Context: Liz is a woodworker. Recently, I found a client who owns a wooden boat that needs repairs. This is a great project but requires someone who has some experience doing this sort of work. I have no idea if Liz has ever done any wooden boat repair, so I thought:

S Context: Liz is a woodworker. Recently, I found a client who owns a wooden boat that needs repairs. This is a great project but requires experience repairing wooden boats. I know that Liz used to repair wooden boats when she started out, but I have no idea if she still does. So, I thought:

If Liz continues repairing wooden boats, then this project will be a great opportunity.

iv)

EI Context: Emily is doing a documentary on the effects that trading at the stock exchange has on companies. She's looking to talk both to entrepreneurs who have substantial stock experience, as well as to entrepreneurs who have never done this. I know that Arthur is an entrepreneur, but I have no idea if he has ever traded in the stock exchange. So, I thought: If Arthur either continues trading at the stock exchange or has never traded there, then Emily might want to talk to him.

If Arthur either has never traded at the stock exchange or continues trading there, then Emily might want to talk to him.

If Arthur either likes trading at the stock exchange or has never traded there, then Emily might want to talk to him.

If Arthur either has never traded at the stock exchange or likes trading there, then Emily might want to talk to him.

EI Context: Emily is doing a documentary on the effects that trading at the stock exchange has on companies. She's looking to talk to entrepreneurs who have experience trading at the stock exchange and still do. I know that Arthur is an entrepreneur, but I have no idea if he has ever traded at the stock exchange. So, I thought:

S Context: Emily is doing a documentary on the effects that trading at the stock exchange has on companies. She's looking to talk to entrepreneurs who have experience trading at the stock exchange and still do. I know that Arthur is an entrepreneur who used to trade at the stock exchange, but I don't know if he still does. So, I thought:

If Arthur continues trading at the stock exchange, then Emily might want to talk to him.

v)

EI Context: I heard that Andrea might be interested in water-related activities. I found a book about fishing that caters both to the advanced and to the novice fisherman. I have no idea if Andrea has ever fished before, so I thought:

If Andrea either continues fishing or has never fished before, then she should find this book interesting.

If Andrea either has never fished before or continues fishing, then she should find this book interesting.

If Andrea either likes fishing or has never fished before, then she should find this book interesting.

If Andrea either has never fished before or likes fishing, then she should find this book interesting.

EI Context: Andrea is interested in water-related activities. I found a book about fishing, which requires some familiarity with basic fishing techniques. I have no idea if Andrea has ever fished before, so I thought:

S Context: Andrea is interested in water-related activities. I found a book about fishing, which requires some familiarity with basic fishing techniques. I know that Andrea used to fish back in the day, but I have no idea if she still does. So, I thought:

If Andrea continues fishing, then she should find this book interesting.

vi)

EI Context: I heard that Carl might be interested in small aircraft. For his birthday, I'm thinking of gifting him a short course on flying small airplanes. The course allows participants to choose to be allocated to the beginners' section or the advanced section. I have no idea if Carl has ever piloted any kind of small aircraft, so I thought:

If Carl either continues piloting small aircraft or has never piloted such aircraft before, he should find the course exciting.

If Carl either has never piloted a small aircraft before or continues piloting such aircraft, he should find the course exciting.

If Carl either likes piloting small aircraft or has never piloted such aircraft before, he should find the course exciting.

If Carl either has never piloted a small aircraft before or likes piloting such aircraft, he should find the course exciting.

EI Context: Carl is interested in small aircraft. For his birthday, I'm thinking of gifting him a short course on flying small airplanes. However, the course requires participants to have some experience with piloting small aircraft. I have no idea if Carl has ever piloted any kind of small aircraft, so I thought:

S Context: Carl is interested in small aircraft. For his birthday, I'm thinking of gifting him a short course on flying small airplanes. However, the course requires participants to have some experience with piloting small aircraft. I know that Carl used to pilot small aircraft back in the day, but I don't know if he still does. So, I thought:

If Carl continues piloting small aircraft, then he should find this course exciting.

vii)

EI Context: I heard that Johanna might have an interest in art. I found a book that goes deep into techniques about drawing landscapes: it's aimed both at people with some drawing experience who want some instruction in the intricacies of landscapes, and at people with no prior drawing experience. I have no idea if Johanna has ever done any drawing. So, I thought:

If Johanna either continues drawing landscapes or has never drawn a landscape before, then this book should be of interest to her.

If Johanna either has never drawn a landscape before or continues drawing landscapes, then this book should be of interest to her.

If Johanna either likes drawing landscapes or has never drawn a landscape before, then this book should be of interest to her.

If Johanna either has never drawn a landscape before or likes drawing landscapes, then this book should be of interest to her.

EI Context: Johanna has an interest in art, and she particularly enjoys landscape paintings. I found a book that goes deep into techniques about drawing landscapes but requires some prior experience. I have no idea if Johanna has ever drawn any kind of landscape. So, I thought:

S Context: Johanna has an interest in art, and she particularly enjoys landscape paintings. I found a book that goes deep into techniques about drawing landscapes but requires some prior experience. I know that Johanna used to draw landscapes, but I don't know if she still does. So, I thought:

If Johanna continues drawing landscapes, then this book should be of interest to her.

viii)

EI Context: Yosiane is interested in water sports. I heard that there's a rowing team down at the river and they're offering courses both to rowers who have substantial prior experience and want to take the next step, as well as to absolute beginners. I have no idea if Yosiane has done any kind of rowing before, so I thought:

If Yosiane either continues rowing or has never rowed before, then she should find the courses interesting.

If Yosiane either has never rowed before or continues rowing, then she should find the courses interesting.

If Yosiane either likes rowing or has never rowed before, then she should find the courses interesting.

If Yosiane either has never rowed before or likes rowing, then she should find the courses interesting.

EI Context: Yosiane is interested in water sports. I heard that there's a rowing team down at the river and they're offering courses to beginners who have some prior experience. I have no idea if Yosiane has done any kind of rowing before, so I thought:

S Context: Yosiane is interested in water sports. I heard that there's a rowing team down at the river and they're offering courses to beginners who have some prior experience. I know that Yosiane has done some rowing before, so I thought:

If Yosiane continues rowing, then she should find the courses interesting.

Again

i)

EI Context: There's a new show at the theater. I want to go tomorrow, but it's quite pricey.

Nonetheless, if you have a theater subscription and you go with a friend, the friend gets a discount. Even better, subscription-holders get to bring a friend for free if they go to the same show twice. Mary has a subscription, but I don't know if she's been to any performance of this new show. So, I thought:

If Mary is either going to the show again, or hasn't been to it so far, then maybe we can go together.

If Mary either hasn't been to the show so far or is going to it again, then maybe we can go together.

EI Context: There's a new show at the theater. I want to go, but it's quite pricey. However, there's a special deal: just for tomorrow, anyone with a theater subscription can bring a friend for free! Moreover, subscription-holders can always get a discounted extra ticket. Mary has a subscription, but I don't know if she's been to any performance of this new show. So, I thought:

If Mary is either going to the show tomorrow, or hasn't been to it so far, then maybe we can go together.

If Mary either hasn't been to the show so far, or is going to it tomorrow, then maybe we can go together.

EI Context: There's a new show at the theater. I want to go tomorrow, but it's quite pricey. Nonetheless, if you have a subscription and you went to at least one performance, then you can go a second time and take someone with you for free. Mary has a subscription, but I don't know if she has been to any performance of this new show. So, I thought:

S Context: There's a new show at the theater. I want to go tomorrow, but it's quite pricey. Nonetheless, if you have a subscription and you went to at least one performance, then you can go a second time and take someone with you for free. Mary has a subscription, and I know that she went to a performance of this new show last week. So, I thought:

If Mary is going to the show again, then maybe we can go together.

ii)

EI Context: Richard is traveling tomorrow and is renting a car at the airport. Avis is offering a deal: if you have rented a car from them in the past and you rent one a second time, you get a 25% discount. You also get a 50% discount if you are renting any car from them for the first time. I have no idea if Richard has ever rented a car from Avis, so I thought:

If Richard is either renting a car from Avis again, or has never rented a car from them before, then he can get a good deal.

If Richard either has never rented a car from Avis before, or is renting a car from them again, then he can get a good deal.

EI Context: Richard is traveling and is renting a car at the airport. Avis is offering a deal: just for tomorrow, anyone renting a car from them gets a 25% discount. There is also a general 50% discount all month if you are renting a car from them for the first time. I have no idea if Richard has ever rented a car from Avis, so I thought:

If Richard is either renting a car from Avis tomorrow, or has never rented a car from them before, then he can get a good deal.

If Richard either has never rented a car from Avis before, or is renting a car from them tomorrow, then he can get a good deal.

EI Context: Richard is traveling tomorrow and is renting a car at the airport. Avis is offering a deal: if you have rented a car from them in the past, then you get a 25% discount. I have no idea if Richard has ever rented a car from Avis, so I thought:

S Context: Richard is traveling tomorrow and is renting a car at the airport. Avis is offering a deal: if you have rented a car from them in the past, then you get a 25% discount. I know Richard has rented a car from Avis in the past, so I thought:

If Richard is renting a car from Avis again, then he can get a good deal.

iii)

EI Context: I heard that Karl is planning a mountain-climbing trip this summer, and is thinking of booking the trip through my travel agency. We offer mountain climbing trips both for beginners as well as experienced climbers. I have no idea if Karl has ever done mountain climbing previously, so I thought:

If Karl is either going mountain climbing again or has never been mountain climbing before, then booking through my company is the right choice.

If Karl either has never been mountain climbing before or is going mountain climbing again, then booking through my company is the right choice.

EI Context: I heard that Karl might want to go on a mountain-climbing trip, and is thinking of booking the trip through my travel agency. We specialize in summer mountain climbing trips as well as mountain climbing trips for absolute beginners. I have no idea if Karl has ever done mountain climbing previously, so I thought:

If Karl is either going mountain climbing this summer or has never been mountain climbing before, then booking through my company is the right choice.

If Karl either has never been mountain climbing before or is going mountain climbing this summer, then booking through my company is the right choice.

EI Context: Karl is planning a trip, and is thinking about booking through my travel agency. We specialize in mountain climbing trips that are always geared towards the more experienced crowd. I have no idea if Karl has ever tried mountain climbing before, so I thought:

S Context: Karl is planning a trip, and is thinking about booking through my travel agency. We specialize in mountain climbing trips that are always geared towards the more experienced crowd. I know that Karl has climbed quite a bit before, so I thought:

If Karl is going mountain climbing again, then booking through my company is the right choice.

iv)

EI Context: There is a Stradivarius exhibit in town, showcasing many famous violins of great historical value. When I visited the exhibit, I saw David there - a historian of musical instruments with notable work on woodwinds. The exhibit has parts that cater to experts on string instruments and parts that are aimed at people with a general interest in the topic. I have no idea if David has ever researched string instruments, so, I thought:

If David is either researching string instruments again or has never researched such instruments before, then there are definitely things here that will attract his interest.

If David has either never researched string instruments before or is researching string instruments again, then there are definitely things here that will attract his interest.

If David is either researching string instruments these days or has never researched string instruments before, then there are definitely things here that will attract his interest.

If David has either never researched string instruments before or is researching string instruments these days, then there are definitely things here that will attract his interest.

EI Context: There is a Stradivarius exhibit in town, showcasing many famous violins of great historical value. However, the presentation caters mostly to experts on string instruments. I went to it the other day, and saw David there - a historian of musical instruments with notable work on woodwinds. I have no idea if he has ever researched string instruments, so, I thought:

S Context: There is a Stradivarius exhibit in town, showcasing many famous violins of great historical value. However, the presentation caters mostly to experts on string instruments. I went to it the other day, and saw David there - a historian of musical instruments with notable work on woodwinds. I know that many years ago he was researching string instruments. So, I thought:

If David is researching string instruments again, then there are definitely things here that will attract his interest.

v)

EI Context: The British museum offers various subscription packages. The best subscription to start with is the "Ancient World" subscription, which allows access to all of the famous exhibits. However, it's usually quite expensive. But this year, there is a special discount for it! I heard that Anne might be interested in a British Museum subscription. I have no idea if she ever had one before, but I thought:

If Anne is either buying a subscription for the British museum again or has never bought such a subscription before, then she should check out the "Ancient World" subscription.

If Anne either has never bought a subscription for the British Museum before or is buying such a subscription again, then she should check out the "Ancient World" subscription.

If Anne is either buying a subscription for the British museum this year or has never bought such a subscription before, then she should check out the "Ancient World" subscription.

If Anne either has never bought a subscription for the British Museum before or is buying such a subscription this year, then she should check out the "Ancient World" subscription.

EI Context: The British museum offers various subscription packages: some focus on the Ancient Egypt exhibits, others on Ancient Greece etc. Current discount offers make the ones on Ancient Egypt and Ancient Greece the best deal. I heard that Anne might be interested in a British museum subscription, but I have no idea if she ever had one before. So, I thought:

S Context: The British museum offers various subscription packages: some focus on the Ancient Egypt exhibits, others on Ancient Greece etc. Current discount offers make the ones on Ancient Egypt and Ancient Greece the best deal. I know that Anne had a British Museum subscription once before, but I don't know which one. So, I thought:

If Anne is buying a subscription for the British museum again, she should get one of the subscriptions currently on special offer.

vi)

EI Context: I overheard George talk about taking driving lessons. I found a good book with many insights, that is suitable both for people who have taken driving lessons in the past but want to renew their license, as well as people who haven't ever taken such lessons. I have no idea if George has ever taken driving lessons, so I thought:

If George is either taking driving lessons again or has never taken such lessons, then this book should prove a useful resource.

If George has either never taken driving lessons or is taking such lessons again, then this book should prove a useful resource.

EI Context: I overheard George talk about taking driving lessons. I found a good book with many insights that is suitable both for people who are currently in the process of taking driving lessons, and for people who haven't ever taken such lessons and want some preparation. I have no idea is George has ever taken driving lessons, so I thought:

If George is either taking driving lessons currently or has never taken such lessons, then this book should prove a useful resource.

If George has either never taken driving lessons or is taking such lessons currently, then this book should prove a useful resource.

EI Context: I overheard George talk about taking driving lessons. I found a good book with many insights, that is aimed towards people who have taken driving lessons in the past but want to renew their license. I have no idea if George has ever taken driving lessons, so I thought:

S Context: I overheard George talk about taking driving lessons. I found a good book with many insights, that is aimed towards people who have taken driving lessons in the past but want to renew their license. I know that George has taken driving lessons in the past, so I thought:

If George is taking driving lessons again, then this book might be a useful resource.

vii)

EI Context: Alfred recently left his job as an engineer. The other day, I saw him wearing a military training uniform. Two kinds of soldiers wear this uniform: recruits who have never been in the military before, and people with some military experience who train to become an officer. Alfred has always had a fascination with the military, but I have no idea if he ever served. So, I thought:

If Alfred is either serving in the military again, or has never served in it before, then that's why he's wearing this uniform.

If Alfred has either never served in the military before or is serving in it again, then that's why he's wearing this uniform.

EI Context: Alfred recently left his job as an engineer. The other day, I saw him wearing a military training uniform: this is a uniform worn by drill sergeants, and by recruits who have never been in the military before. Alfred has always had a fascination with the military, but I have no idea if he ever served. So, I thought:

If Alfred is either currently serving in the military as a drill sergeant or has never served in it before, then that's why he's wearing this uniform. If Alfred has either never served in the military before or is currently serving in it as a drill sergeant, then that's why he's wearing this uniform.

EI Context: I heard that Alfred may have changed careers recently. The other day I saw him wearing a drill sergeant's uniform. Drill sergeants usually have prior military experience, but I have no idea if Alfred ever served in the military. So, I thought:

S Context: I heard that Alfred may have changed careers recently. The other day I saw him wearing a drill sergeant's uniform. Drill sergeants usually have prior military experience. I know that Alfred served in the military when he was younger, so I thought:

If Alfred is serving in the military again, then that's why he's wearing this uniform.

viii)

EI Context: I heard that Elizabeth might be traveling to the Arctic circle in the winter. I found a book aimed both at people who have some experience traveling to the higher Arctic regions, as well as at first-time Arctic travelers. I have no idea if Elizabeth has ever been to the Arctic circle before, so I thought:

If Elizabeth is either going to the Arctic again or has never been there before, then she will appreciate the value of this book.

If Elizabeth has either never been to the Arctic before or is going there again, then she will appreciate the value of this book.

EI Context: I heard that Elizabeth might be traveling to the Arctic circle. I found a book aimed both at people who are attempting a trip to the Arctic during winter-time (which comes with special challenges), as well as to first-time Arctic travelers. I have no idea if Elizabeth has ever been to the Arctic circle before, so I thought:

If Elizabeth is either going to the Arctic in the winter or has never been there before, then she will appreciate the value of this book.

If Elizabeth has either never been to the Arctic before or is going there in the winter, then she will appreciate the value of this book.

EI Context: I heard that Elizabeth might be traveling to the Arctic circle in the winter. I found a book aimed at people who have some experience traveling in the Arctic regions, and want to explore the more inaccessible bits. I have no idea if Elizabeth has ever been to the Arctic circle before, so I thought:

S Context: I heard that Elizabeth might be traveling to the Arctic circle in the winter. I found a book aimed at people who have some experience traveling in the Arctic regions, and want to explore the more inaccessible bits. I know that Elizabeth has been to the Arctic circle before, so I thought:

If Elizabeth is going to the Arctic circle again, then she will appreciate the value of this book.

A.2.3. Fillers

GoodCond:

1)

My friend Saul is a philosopher and has been working on a new theory for the past year. However, he has been very secretive about it. Yesterday he told me that he was almost done with the work, but given how secretive he has been I'm not sure whether he will publish it. So, I thought:

If Saul publishes his new theory, then that will make the other philosophers very excited.

2)

Ted has been in love with Robin for many months now and we have all been wondering whether or not he will do anything about this at some point. One day, Ted finally decided that he was going to ask her out. I'm not sure if Robin likes Ted back, so I thought:

If Ted asks Robin out and she says "no", then Ted will be crushed.

3)

John and Mary are avid theater goers and usually don't miss a performance. However, John cannot stand opera. This week the theater is putting on an opera by Wagner, but I'm not sure if John and Mary are aware of this. So I thought:

If John and Mary go to the theater this week, John will encounter a nasty surprise.

4)

My friend Ava was planning to go on vacation in the Netherlands. One day, I stopped by her house and I saw that the lights were on. I did not know her itinerary exactly and I wasn't sure if she was gone, so I thought:

If Ava has not left for her vacation yet, then maybe she has time to have a cup of tea with me.

5)

Rachel is a professor of mathematics. One day I stopped by her house and I saw that it was packed with books on algebra. I had a vague impression that her specialization was in geometry but I wasn't sure about this as she never really talked about her work. So I thought:

If Rachel specializes in algebra, then it makes sense that she has all these books.

6)

My friend Rob has spent some time in Russia but I don't know if he learned Russian while he was there. One day, I saw him browsing the Russian-language section in a bookstore. So I thought:

If Rob can speak Russian, then he must be looking for reading material.

7)

Christopher is participating in a treasure hunt. The clues take the form of math-based puzzles, which is not exactly Chistopher's strong point. So, I thought:

If Christopher finds the treasure, then that will be quite impressive.

8)

Stephen is taking part in a chess tournament. He's currently playing a game against a quite strong opponent. But if he wins, then he'll be up against much weaker players for the rest of the tournament. So, I thought:

If Stephen wins this game, then he'll have a good chance of finishing first in the tournament.

9)

Tom is going on a tour of France. I've always been fascinated by the small town of Tonnerre, which boasts a vast Karst spring called the "Fosse Dione". So, I thought:

If Tom passes through Tonnerre, then maybe he can bring me some water from the “Fosse Dione”.

10)

Peter and I were dining at a restaurant last night. Peter disliked the food and was determined to ask for his money back. When he got up to do so, I thought: If Peter doesn’t get his money back, he’ll throw a tantrum.

11)

Me and Catherine are both geologists. I need some data on a glacier in Iceland. However, I’m very busy and cannot currently make the trip. I heard that Catherine might be visiting Iceland to survey one of the volcanoes there. So, I thought:

If Catherine visits Iceland, then maybe I can have her gather some data on the glacier.

12)

Daniel is a mathematician friend who works on number theory. One day he told me that he’s secretly been working on the Riemann Hypothesis, one of the hardest unsolved problems in the field. So, I thought:

If Daniel solves the Riemann Hypothesis, he’ll become famous overnight.

BadCond

1)

Ethan is on a trip and his first stop is England. His friend Olivia lives there and has invited him over for dinner during the days he’ll be spending there. So, I thought:

If Ethan isn’t coming to England, then Olivia will invite someone else for dinner.

2)

The Louvre has a new exhibition of medieval art. Melanie is an art critic and is in Paris to review the new exhibition. So I thought:

If Melanie isn't in Paris then something must have happened on her trip.

3)

My wife Joan is a doctor and she is often called away on various emergency visits. Tonight Joan was called away on such an emergency, and she told me she wouldn't be home. So I thought:

If Joan is home tonight, then we will be able to catch up on some TV.

4)

Alex was invited to give a talk at a conference in Athens, and I just saw him board the train to travel there. So I thought:

If Alex isn't on the train, then the organizers of the conference will be mad.

5)

My friend Helen has been writing a book, and recently she managed to find a publisher with whom she signed a contract. So, I thought:

If Helen isn't writing a book, then her publisher will take her to court.

6)

Peter met with his friend Abigail in the park yesterday. Afterwards, Peter went missing, and the police asked Abigail if she knew anything, since she was the last person to see him. So, I thought:

If Abigail didn't see Peter yesterday, then the police are grasping at straws.

7)

There's a new film at the cinema this week. Both me and Liam are interested in watching it. Liam had told me that he would go watch it yesterday. However, he ended up having to work late and couldn't go. I'm thinking of going to cinema tonight, so I thought:

If Liam went to the cinema yesterday, I should ask him what he thought of the film.

8)

Our math teacher gave us a very difficult problem as homework, and I wasn't able to solve it. Actually, no one in class had managed to tackle it, not even Theodore who usually excels at math. So, I thought:

If Theodore solved the problem, then I should ask him to help me.

9)

Charlotte is the understudy for Lady Macbeth's role in her school's production of "Macbeth". She wants to be on stage very much, but hasn't gotten a chance so far. Unfortunately, last night she also had to stay on the sidelines. So, I thought:

If Charlotte performed last night, I should ask her how it went.

10)

There was a robbery at the store where Sophia works. Sophia didn't see the thief, but the police still wanted to ask her a few questions. So, I thought:

If Sophia saw the thief, then maybe she can describe him to the police.

11)

We took a test at school the other day, and most of the class did poorly. However, Evelyn scored perfectly on it. So, I thought:

If Evelyn didn't do well on the test, then she must be very disappointed.

12)

The president was supposed to visit Oliver's school. Oliver was very excited to meet him. However, the visit was canceled at the last minute. So, I thought:

If Oliver met the president, then I wonder what he thought of him.

APPENDIX B

STIMULI FOR CHAPTER 5 EXPERIMENTS

B.1. Experiment 1

B.1.1. Critical Items

Again

(i)

EI Context: William researches the history of music, and he currently works on woodwinds. The other day I saw a bunch of books lying about his floor. One of the books was about the cello. I have no idea if he ever had research interests in stringed instruments, so I thought:

S Context: William researches the history of music, and he currently works on woodwinds. The other day I saw a bunch of books lying about his floor. One of the books was about the cello. I know that he previously had research interests in stringed instruments, so I thought:

If William is not getting interested in stringed instruments again and he's had an interest in the cello previously, then he might just be throwing this book away.

If William is getting interested in stringed instruments again and he's had an interest in the cello previously, that would explain why he's perusing this book.

(ii)

EI Context: John likes to go to the beach at least a few times every summer. Around the beginning of August, I saw that he packed up all his beach items and stowed them away. I have no idea if he went to the beach this summer at all, so I thought:

S Context: John likes to go to the beach at least a few times every summer. Around the beginning of August, I saw that he packed up all his beach items and stowed them away. I know that he's been to the beach this summer, although I'm not sure how many times. So I thought:

If John is not going to the beach again and he's been there a few times already this summer, then it makes sense that he's packed up his beach stuff.

If John is not going to the beach again and he's been there a few times already this summer, then it makes sense that he's packed up his beach stuff.

Stop

(i)

EI Context: Liz has been involved in various sports since a young age, but recently she started giving some of them up. Mary is interested in tennis, and wants to enter an upcoming doubles tennis tournament. I don't know if Liz was ever involved with any kind of tennis matches, so I thought:

S Context: Liz has been involved in various sports since a young age, but recently she started giving some of them up. There's a large doubles tennis tournament coming up. I know that Liz has been an avid tennis player, so I thought:

If Liz hasn't stopped playing tennis and she has played in doubles tournaments in the past, then she should definitely enter this tournament.

EI Context: Liz has been involved in various sports since a young age, but recently she started giving some of them up. Mary is interested in tennis, and wants to enter an upcoming doubles tennis tournament. I don't know if Liz was ever involved with any kind of tennis matches, so I thought:

S Context: Liz has been involved in various sports since a young age, but recently she started giving some of them up. Mary is interested in tennis, and wants to enter an upcoming doubles tennis tournament. I know that Liz has been an avid tennis player, so I thought:

If Liz has stopped playing tennis and she has played in doubles tournaments in the past, then she might have time to coach Mary.

(ii)

EI Context: Joan has played various card games professionally, although recently she has been thinking about retiring. Martin is interested in entering Duplicate bridge competitions. I have no idea if Joan ever took part in any kind of bridge competition, so I thought:

S Context: Joan has played various card games professionally, although recently she has been thinking about retiring. Martin is interested in entering Duplicate bridge competitions. I know that Joan has participated in countless bridge tournaments, so I thought:

If Joan hasn't stopped participating in bridge competitions and she has participated in Duplicate Bridge tournaments in the past, then maybe she could help Martin.

If Joan has stopped participating in bridge competitions and she has participated in Duplicate Bridge tournaments in the past, then maybe she has time to help Martin.

Continue

(i)

EI Context: My friend John is a literature professor. One day, I stopped by his house and I saw a neglected copy of Tolkien's 'The Fellowship of the Ring' lying around. I have no idea if John ever had research interests in Tolkien, so I thought:

S Context: My friend John is a literature professor. One day, I stopped by his house and I saw a neglected copy of Tolkien's 'The Fellowship of the Ring' lying around. I know that John used to have research interests in Tolkien, so I thought:

If John does not continue having research interests in Tolkien and in the past he was specifically interested in Tolkien's fantasy writings, then it makes sense that this book is neglected.

If John continues having research interests in Tolkien and in the past he was specifically interested in Tolkien's fantasy writings, then it's weird that this book is neglected.

(ii)

EI Context: Matt wants to interview people who used to do Jivamukti yoga but stopped. Mary likes exercise, but I have no idea if she ever did yoga. So I thought:

S Context Matt wants to interview people who used to do Jivamukti yoga but stopped. Mary likes exercise, and she has done yoga in the past. So, I thought:

If Mary doesn't continue doing yoga and in the past she did Jivamukti yoga, then Matt will want to interview her.

If Mary continues doing yoga and in the past she did Jivamukti yoga, then Matt will not want to interview her.

Find out

(i)

EI Context: Sue likes to keep close tabs on her husband, Donald. One day I saw a ticket from the Berlin opera in Donald's office. I don't know whether Donald visited Germany, so I thought:

S Context: Sue likes to keep close tabs on her husband, Donald. One day I saw a ticket from the Berlin opera in Donald's office. I know that he visited Germany recently. So I thought:

If Sue didn't find out that Donald visited Germany and he visited Berlin, then that would be very strange.

If Sue found out that Donald visited Germany and he visited Berlin, then she must know about the opera ticket.

(ii)

EI Context: Mary owns a house next to a lake. I heard that there was extensive flooding in the lake area and that the lake's dam was in danger of breaking. Part of the dam is next to Mary's house, so if the dam broke, her house would be destroyed. I have no idea if any part the dam broke in the end, so I thought:

S Context: Mary owns a house next to a lake. I heard that there was extensive flooding in the lake area and that the lake's dam was in danger of breaking. Part of the dam is next to Mary's house, so if the dam broke, her house would be destroyed. I read on the news yesterday that some part of the dam collapsed. So, I thought:

If Mary didn't find out that the dam broke somewhere and it broke at the point next to her house, then she will be surprised by the damage to the property.

If Mary found out that the dam broke somewhere and it broke at the point next to her house, then she must be rushing to the area.

Happy

(i)

EI Context: Ada is very good friends with John and whenever John visits they have a good time. But every time he leaves, this initially makes her sad. I talked to Ada on the phone today and she sounded very down. I know that John was visiting, but I had no idea whether he had left. So I thought:

S Context: Ada is very good friends with John and whenever John visits they have a good time. But every time he leaves, this initially makes her sad. I talked to Ada on the phone today and she sounded very down. I know that John was visiting, but left at some point. So I thought:

If Ada is not happy that John left and John left recently, then it makes sense that she sounds so sad.

EI Context: Ada is friends with John and whenever John visits they have a good time at first.

But John always ends up getting on her nerves in the end. I talked to Ada on the phone the other day and she sounded very relaxed. I know that John was visiting her, but I had no idea whether he had left. So I thought:

S Context: Ada is friends with John and whenever John visits they have a good time at first. But John always ends up getting on her nerves in the end. I talked to Ada on the phone the other day and she sounded very relaxed. I know that John was visiting her, but left at some point. So I thought:

If Ada is happy that John left and John left recently, then that must be why she sounds so relaxed.

(ii)

EI Context: Mary has always suspected her husband, John, of having a secret girlfriend in Paris. Yesterday, I was talking to Mary on the phone and she sounded very sad. I heard that John was thinking of travelling to Paris, but I have no idea if he is going through with it. So, I thought:

S Context: Mary has always suspected her husband, John, of having a secret girlfriend in Paris. Yesterday, I was talking to Mary on the phone and she sounded very sad. I know that John is going to Paris, although I'm not sure when exactly. So, I thought:

If Mary is not happy that John is going to Paris and John is travelling there soon, then this must be what's making her sad.

EI Context: Mary always doesn't like it when her husband, John, sticks for too long around the house. Yesterday, I talked to Mary on the phone and she sounded very excited. I heard that John was thinking of going to Paris, but I have no idea if he is actually going. So, I thought:

S Context: Mary always doesn't like it when her husband, John, sticks for too long around the house. Yesterday, I talked to Mary on the phone and she sounded very excited. I know that John is going to Paris, although I'm not sure when exactly. So, I thought:

If Mary is happy that John is going to Paris and he's travelling there soon, then this must be why she's excited.

Aware

(i)

EI Context: Harry and Emily were married for a few years but then got divorced. Afterwards, Harry moved to New York and Emily moved to England. I heard that Emily was thinking about coming back to the States, specifically to New York. However, I have no idea whether she is actually doing this. So, I thought:

S Context: Harry and Emily were married for a few years but then got divorced. Afterwards, Harry moved to New York and Emily moved to England. I heard that Emily was thinking about coming back to the States, specifically to New York. I talked to her and she told me that she is indeed coming back to the States. So, I thought:

If Harry is aware that Emily is coming to the States and she is coming to New York, then he must be fuming.

If Harry is not aware that Emily is coming to the States and she is coming to New York, then he will blow his top off.

(ii)

EI Context: David's daughter, Margaret, tends to be quite rowdy and she often shoplifts. However, her parents do not take this seriously. Margaret has been missing for a few days and there is a suspicion that she has been arrested, but no one in the family knows for sure yet. So I thought:

S Context: David's daughter, Margaret, tends to be quite rowdy and she often shoplifts. However, her parents do not take this seriously. Margaret was arrested yesterday, but I'm not sure if David knows this yet. So I thought:

If David is not aware that his daughter has been arrested and she's been arrested for shoplifting, then a call from the police will be an unpleasant surprise.

If David is aware that his daughter has been arrested and she's been arrested for shoplifting, then he will finally be forced to take this seriously.

B.1.2. Fillers

GoodCond

My friend Saul is a philosopher and has been working on a new theory for the past year. However, he has been very secretive about it. Yesterday he told me that he was almost done with the work, but given how secretive he has been I'm not sure whether he will publish it. So, I thought:

If Saul publishes his new theory, then that will make the other philosophers very excited.

Ted has been in love with Robin for many months now and we have all been wondering whether or not he will do anything about this at some point. One day, Ted finally decided that he was going to ask her out. I'm not sure if Robin likes Ted back, so I thought:

If Ted asks Robin out and she says "no", then Ted will be crushed.

John and Mary are avid theatre goers and usually don't a miss a performance. However, John cannot stand opera. This week the theatre is putting on an opera by Wagner, but I'm not sure if John and Mary are aware of this. So I thought:

If John and Mary go to the theatre this week, John will encounter a nasty surprise.

My friend Ava was planning to go on vacation in the Netherlands. One day, I stopped by her house and I saw that the lights were on. I did not know her itinerary exactly and I wasn't sure if she was gone, so I thought:

If Ava has not left for her vacation yet, then maybe she has time to have a cup of tea with me.

Rachel is a professor of mathematics. One day I stopped by her house and I saw that it was packed with books on algebra. I had a vague impression that her specialization was in geometry but I wasn't sure about this as she never really talked about her work. So I thought:

If Rachel specializes in algebra, then it makes sense that she has all these books.

My friend Rob has spent some time in Russia but I don't know if he learned Russian while he was there. One day, I saw him browsing the Russian-language section in a bookstore. So I thought:

If Rob can speak Russian, then he must be looking for reading material.

BadCond

Ethan is on a trip and his first stop is England. His friend Olivia lives there and has invited him over for dinner during the days he'll be spending there. So, I thought:

If Ethan isn't coming to England, then Olivia will invite someone else for dinner.

The Louvre has a new exhibition of medieval art. Melanie is an art critic and is in Paris to review the new exhibition. So I thought:

If Melanie isn't in Paris then something must have happened on her trip.

Joan is a doctor and she is often called away on various emergency visits. Tonight Joan was called away on such an emergency, and she told me she wouldn't be home. So I thought:

If Joan is home tonight, then we will be able to catch up on some TV.

Alex was invited to give a talk at a conference in Athens, and I just saw him board the train to travel there. So I thought:

If Alex isn't on the train, then the organisers of the conference will be mad.

My friend Helen has been writing a book, and recently she managed to find a publisher with whom she signed a contract. So, I thought:

If Helen isn't writing a book, the her publisher will take her to court.

Peter met with his friend Abigail in the park yesterday. Afterwards, Peter went missing, and the police asked Abigail if she knew anything, since she was the last person to see him. So, I thought:

If Abigail didn't see Peter yesterday, then the police are grasping at straws.

B.2. Experiment 2

Too

(i)

EI Context: John likes to go to the theater and Mary often accompanies him. Currently, there's a new show on, but Mary is available only on Thursday. Nevertheless, I heard that recently John and Mary got into a fight. I saw John outside the theater on Thursday, but I have no idea if he attended the performance. So, I thought:

If it's not the case that Mary attended the performance too, and it is the case that John attended the performance on Thursday, then their fight was serious.

If it's the case that John attended the performance on Thursday, and it is not the case that Mary attended the performance too, then their fight was serious.

If it's the case that Mary attended the performance too, and it is the case that John attended the performance on Thursday, then their fight wasn't serious.

If it's the case that John attended the performance on Thursday, and it is the case that Mary attended the performance too, then their fight wasn't serious.

S Context: John likes to go to the theater and Mary often accompanies him. Currently, there's a new show on, but Mary is available only on Thursday. Nevertheless, I heard that recently John and Mary got into a fight. I saw John outside the theater on Thursday, and I know he attended the performance then. So, I thought:

If it's not the case that Mary attended the performance too, then their fight was serious.

(ii)

EI Context: Emily and Bill are the best students in their math class. Usually, both of them are able to solve all of the problems, although Emily often manages to solve really hard problems that Bill fails on, and she's quite fast at it as well. This week, the teacher decided to give them both a quite intricate problem. I have no idea if Emily solved it, but I thought:

If it's not the case that Bill solved the problem too, and it is the case that Emily solved it slowly, then it must have been very hard.

If it's the case that Emily solved the problem slowly, and it is not the case that Bill solved it too, then it must have been very hard.

If it's the case that Bill solved the problem too, and it is the case that Emily solved it quickly, then it must not have been very hard.

If it's the case that Emily solved the problem quickly, and it is the case that Bill solved it too, then it must not have been very hard.

S Context: Emily and Bill are the best students in their math class. Usually, both of them are able to solve all of the problems, although Emily often manages to solve really hard problems that Bill fails on, and is quite fast at it as well. This week, the teacher decided to give them both a quite intricate problem. I know that Emily solved it, so I thought:

If it's not the case that Bill solved the problem too, then it must have been very hard.

(iii)

EI Context: There is an ancient Greece exhibition at the museum this week. Jim is an archaeologist and really wants to go. Amanda also enjoys such exhibits and whenever Jim goes to the museum she usually goes with him. They are trying to figure out a common time to go: Mary is free only on one day this week. I bumped into Jim close to the museum on Thursday. I have no idea if he actually visited the exhibition, but I thought:

If it's not the case that Amanda visited the exhibition too, and it is the case that Jim visited the exhibition on Thursday, then their schedules must have been incompatible after all.

If it's the case that Jim visited the exhibition on Thursday, and it is not the case that Amanda visited the exhibition too, then their schedules must have been incompatible after all.

If it's the case that Amanda visited the exhibition too, and it is the case that Jim visited the exhibition on Thursday, then their schedules must have been compatible after all.

If it's the case that Jim visited the exhibition on Thursday, and it is the case that Amanda visited the exhibition too, then their schedules must have been compatible after all.

S Context: There is an ancient Greece exhibition at the museum this week. Jim is an archaeologist and really wants to go. Amanda also enjoys such exhibits and whenever Jim goes to the museum she usually goes with him. They are trying to figure out a common time to go: Mary is free only on one day this week. I know that Jim visited exhibition on Thursday, so I thought:

If it's not the case that Amanda visited the exhibition too, then their schedules must have been incompatible after all.

(iv)

EI Context: Martin and Cid are brothers. Martin tends to make stupid decisions, and unfortunately Cid often copies him. Recently, Martin has been wanting to buy a car, specifically a pick-up truck. However, owning a car in the tiny city that Martin and Cid live makes no sense, especially a pick-up truck. I have no idea if Martin bought a car in the end, but I thought:

If it's not the case that Cid bought a car too, and it is the case that Martin bought a pick-up truck, then Cid made the right decision.

If it's the case that Martin bought a pick-up truck, and it is not the case that Cid bought a car too, then Cid made the right decision.

If it's the case that Cid bought a car too, and it is the case that Martin bought a pick-up truck, then Cid made the wrong decision.

If it's the case that Martin bought a pick-up truck, and it is the case that Cid bought a car too, then Cid made the wrong decision.

S Context: Martin and Cid are brothers. Martin tends to make stupid decisions, and unfortunately Cid often copies him. Recently, Martin has been wanting to buy a car, specifically a pick-up truck. However, owning a car in the tiny city that Martin and Cid live makes no sense, especially a pick-up truck. I know that Martin bought a pick-up truck in the end, so I thought:

If it's not the case that Cid bought a car too, then Cid made the right decision.

(v)

EI Context: Nick and Tina are friends. There's this coffee shop that Tina really likes, and she tries to go there on the first of every month. Often, Nick joins her there to catch up. However, I heard recently that they got into a fight. The first of the month was yesterday. I have no idea if Tina went to the coffee shop, but I thought:

If it's not the case that Nick went to the coffee shop too, and it is the case that Tina went to the coffee shop yesterday, then their fight must have been really bad.

If it's the case that Tina went to the coffee shop yesterday, and it is not the case that Nick went to the coffee shop too, then their fight must have been really bad.

If it's the case that Nick went to the coffee shop too, and it is the case that Tina went to the coffee shop yesterday, then their fight must have been minor.

If it's the case that Tina went to the coffee shop yesterday, and it is the case that Nick went to the coffee shop too, then their fight must have been minor.

S Context: Nick and Tina are friends. There's this coffee shop that Tina really likes, and she tries to go there on the first of every month. Often, Nick joins her there to catch up. However, I heard recently that they got into a fight. The first of the month was yesterday. I know that Tina went to the coffee shop, so I thought:

If it's not the case that Nick went to the coffee shop too, then their fight must have been really bad.

(vi)

EI Context: Liam is very competitive, and whenever Anna applies for a job, he applies for a similar one. There are a couple of academic jobs that Anna is thinking of applying to. One of them is in London, and would be the best fit for her. I have no idea if she applied for any academic job, but I thought:

If it's not the case that Liam applied for an academic job too, and it is the case that Anna applied for the academic job in London, then maybe their competition is dying down.

If it's the case that Anna applied for the academic job in London, and it is not the case that Liam applied for an academic job too, then their competition is dying down.

If it's the case that Liam applied for an academic job too, and it is the case that Anna applied for the academic job in London, then their competition isn't dying down.

If it's the case that Anna applied for the academic job in London, and it is the case that Liam applied for an academic job too, then their competition isn't dying down.

S Context: Liam is very competitive, and whenever Anna applies for a job, he applies for a similar one. There are a couple of academic jobs that Anna is thinking of applying to. One of them is in London, and would be the best fit for her. I know that she applied for the academic job in London, so I thought:

If it's not the case that Liam applied for an academic job too, then their competition is dying down.

(vii)

EI Context: There's a Picasso exhibit in town and Jack wants to go. Usually, he likes it when Monica comes with him to such exhibits, but because Monica has a complicated schedule, this isn't always possible. Jack wanted to go to the exhibit either this Thursday or this Friday. I bumped into him close to the museum on Thursday. I have no idea if he actually went to the exhibit, but I thought:

If it's not the case that Monica went to the exhibit too, and it is the case that Jack went to it on Thursday, then their schedules must have been incompatible.

If it's the case that Jack went to the exhibit on Thursday, and it is not the case that Monica went to it too, then their schedules must have been incompatible.

If it's the case that Monica went to the exhibit too, and it is the case that Jack went to the exhibit on Thursday, then their schedules must have been compatible.

If it's the case that Jack went to the exhibit on Thursday, and it is the case that Monica went to it too, then their schedules must have been compatible.

S Context: There's a Picasso exhibit in town and Jack wants to go. Usually, he likes it when Monica comes with him to such exhibits, but because Monica has a complicated schedule, this isn't always possible. Jack wanted to go to the exhibit either this Thursday or this Friday. I bumped into him close to the museum on Thursday, and I know that he went to the exhibit then. So, I thought:

If it's not the case that Monica went to the exhibit too, then their schedules must have been incompatible.

(viii)

EI Context: There's a cake festival happening in town this week. Cleo and Tom both have a history of enjoying cake; however, Cleo is an extremely picky eater who only likes exceptional types of chocolate cake, while Tom is currently on a diet and he wouldn't break it for anything else than a truly sublime piece of lemongrass cake. I know they went to the cake festival together. I have no idea if Cleo ate any piece of cake, but I thought:

If it's not the case that Tom ate a piece of cake too, and it is the case that Cleo ate a piece of chocolate cake, then the festival only had exceptional chocolate cake available.

If it's the case that Cleo ate a piece of chocolate cake, and it is not the case that Tom ate a piece of cake too, then the festival only had exceptional chocolate cake available.

If it's the case that Tom ate a piece of cake too, and it is the case that Cleo ate a piece of chocolate cake, then the festival didn't only have exceptional chocolate cake available.

If it's the case that Cleo ate a piece of chocolate cake, and it is the case that Tom ate a piece of cake too, then the festival didn't only have exceptional chocolate cake available.

S Context: There's a cake festival happening in town this week. Cleo and Tom both have a history of enjoying cake; however, Cleo is an extremely picky eater who only likes exceptional types of chocolate cake, while Tom is currently on a diet and he wouldn't break it for anything else than a truly sublime piece of lemongrass cake. I know they went to the cake festival together, and I know that Cleo tried some cake. But I don't know if Tom did. So I thought:

If it's not the case that Tom ate a piece of cake too, then the festival only had exceptional chocolate cake available.

(ix)

EI Context: Kat and Rita are best friends. Rita really likes to try different dyes for her hair, and often Kat joins her. Recently, Rita was thinking about dying her hair green. However, I also heard that she and Kat have been fighting. I have no idea if Rita dyed her hair in the end, but I thought:

If it's not the case that Kat dyed her hair too, and it is the case that Rita dyed her hair green, then their friendship is damaged.

If it's the case that Rita dyed her hair green, and it is not the case that Kat dyed her hair too, then their friendship is damaged.

If it's the case that Kat dyed her hair too, and it is the case that Rita dyed her hair green, then their friendship is not damaged.

If it's the case that Kat dyed her hair too, and it is the case that Rita dyed her hair green, then their friendship is not damaged.

If it's the case that Rita dyed her hair green, and it is the case that Kat dyed her hair too, then their friendship is not damaged.

S Context: Kat and Rita are best friends. Rita really likes to try different dyes for her hair, and often Kat joins her. Recently, Rita was thinking about dying her hair green. However, I also heard that she and Kat have been fighting. I know that Rita ended up dying her hair, so I thought:

If it's not the case that Kat dyed her hair too, then their friendship is damaged.

(x)

EI Context: Amanda and Bill work for a large company, and because of certain logistics, it's easier if they take their vacation at the same time. This year, Bill really wants to go to Hawaii, and this works best in the spring. However, I'm not sure this timeline works for Amanda. I don't know what happened and I have no idea if Bill booked a trip in the end. So, I thought:

If it's not the case that Amanda booked a trip too, and it is the case that Bill booked a trip to Hawaii, then they weren't able to sync their vacation.

If it's the case that Bill booked a trip to Hawaii, and it is not the case that Amanda booked a trip too, then they weren't able to sync their vacation.

If it's the case that Amanda booked a trip too, and it is the castle that Bill booked a trip to Hawaii, then they were able to sync their vacation.

If it's the case that Bill booked a trip to Hawaii, and it is the case that Amanda booked a trip too, then they were able to sync their vacation.

S Context: Amanda and Bill work for a large company, and because of certain logistics, it's easier if they take their vacation at the same time. This year, Bill really wants to go to Hawaii, and this works best in the spring. However, I'm not sure this timeline works for Amanda. I don't know what happened in the end, but I do know that Bill booked his Hawaii trip. So, I thought:

If it's not the case that Amanda booked a trip too, then they weren't able to sync their vacation.

(xi)

EI Context: I've organized a treasure hunt for Ron and Carla: each of them has a series of clues to their own treasure. I tried to strike a balance between fun and interesting. I suspect that Carla will find her treasure first, but I am worried that I made the whole thing too demanding and that probably only Carla will succeed. I don't know the outcome yet, so I have no idea whether Carla found her treasure; but I thought:

If it's not the case that Ron found his treasure too, and it is the case that Carla found hers first, then the hunt was too demanding.

If it's the case that Carla found her treasure first, and it is not the case that Ron found his too, then the hunt was too demanding.

If it's the case that Ron found his treasure too, and it is the case that Carla found hers first, then the hunt wasn't too demanding.

If it's the case that Carla found her treasure first, and it is the case that Ron found his too, then the hunt wasn't too demanding.

S Context: I've organized a treasure hunt for Ron and Carla: each of them has a series of clues to their own treasure. I tried to strike a balance between fun and interesting. I suspect that Carla will find her treasure first, but I am worried that I made it demanding and that probably only Carla will succeed. I know that Carla has found her treasure, but I don't know if Ron has succeeded yet. So, I thought:

If it's not the case that Ron found his treasure too, then the hunt was too demanding.

(xii)

EI Context: Naomi and Jill often do activities together. There's a short story writing competition this semester that Jill has been interested in, because she wanted to try writing a science fiction story. Naomi was thinking about possibly sending a story too. The deadline for submitting a story was yesterday. I don't know if Naomi and Jill ended up having any shared activities this semester; I have no idea if Jill wrote a short story in the end, but I thought:

If it's not the case that Naomi wrote a short story too, and it is the case that Jill wrote a science fiction short story, then they didn't join the competition together.

If it's the case that Jill wrote a science fiction short story, and it is not the case that Naomi wrote a short story too, then they didn't join the competition together.

If it's the case that Naomi wrote a short story too, and it is the case that Jill wrote a science fiction short story, then they joined the competition together.

If it's the case that Jill wrote a science fiction short story, and it is the case that Naomi wrote a short story too, then they joined the competition together.

S Context: Naomi and Jill often do activities together. There's a short story writing competition this semester that Jill has been interested in, because she wanted to try writing a science fiction story. Naomi was thinking about possibly sending a story too. The deadline for submitting a story was yesterday. I don't know if Naomi and Jill ended up having any shared activities this semester; but I know that Jill wrote a short story in the end, so I thought:

If it's not the case that Naomi wrote a short story too, then they didn't join the competition together.

Again

(i)

EI Context: I'm building a model of the Victory (admiral Nelson's flagship) and need a particular hue of paint (specific to 19th-century English warships) to paint the bottom of the ship. The paint is quite rare, so I'm looking to see if any of my friends already have some. John has recently returned to his craft hobbies after overcoming an illness, but I heard that he has given some of them up. I have no idea if he ever built any ship models, but I thought:

If it's not the case that John is building model ships again, and it is the case that he used to build 19th-century English warships, then he may have paint to spare.

If it's the case that John used to build 19th-century English warships, and it's not the case that he's building model ships again, then he may have paint to spare.

If it's the case that John is building model ships again, and he used to build 19th-century English warships, then he may not have paint to spare.

If it's the case that John used to build 19th-century English warships, and he is building model ships again, then he may not have paint to spare.

S Context: I'm building a model of the Victory (admiral Nelson's flagship) and need a particular hue of paint (specific to English warships of the era) to paint the bottom of the ship. The paint is quite rare, so I'm looking to see if any of my friends already have some. John has recently returned to his craft hobbies after overcoming an illness, but I heard that he has given some of them up. I know that he used to build ship models, so I thought:

If it's not the case that John is building model ships again, then he may have paint to spare.

(ii)

EI Context: I'm looking to buy some gear for traveling to the Arctic regions. Liz is well-traveled and I know she visited Sweden last year, although I'm not sure she enjoyed it. I know that she's about to take a new trip to some Scandinavian country. I have no idea if she has ever visited any of the Arctic regions before (in Sweden or otherwise), but I thought:

If it's not the case that on her upcoming trip Liz is traveling to the Arctic regions again, and it is the case that she traveled to the Swedish Arctic last year, then she'll probably have equipment for sale.

If it's the case that Liz traveled to the Swedish Arctic last year, and it is not the case that on her upcoming trip she's traveling to the Arctic regions again, then she'll probably have equipment for sale.

If it's the case that on her upcoming trip Liz is traveling to the Arctic regions again, and it is the case that she traveled to the Swedish Arctic last year, then she probably won't have equipment for sale.

If it's the case that Liz traveled to the Swedish Arctic last year, and it is the case that on her upcoming trip she's traveling to the Arctic regions again, then she probably won't have equipment for sale.

S Context: I'm looking to buy some gear for traveling to the Arctic regions. Liz is well-traveled and I know she visited Sweden last year, although I'm not sure she enjoyed it. I know that she's about to take a new trip to some Scandinavian country. I know that her trip to Sweden included some time in the Arctic regions of the country, so I thought:

If it's not the case that on her upcoming trip Liz is traveling to the Arctic regions again, then she'll probably have equipment for sale.

(iii)

EI Context: Alfred often goes back and forth between careers, leaving one job only to return to it next year. Recently, he left his career as an engineer for something else. Alfred has always had a fascination with the military, and incidentally I'm looking for some used military equipment. I have no idea if his new or any of his previous careers have had anything to do with the military, but I thought:

If it's not the case that Alfred is serving in the military again, and he served in it when he was younger, then he'll probably be willing to give me the equipment I want.

If it's the case that Alfred served in the military when he was younger, and it is not the case that he is serving in it again, then he'll probably be willing to give me the equipment I want.

If it's the case that Alfred is serving in the military again, and it is the case that he served in it when he was younger, then he probably won't be willing to give me the equipment I want.

If it's the case that Alfred served in the military when he was younger, and it is the case that he is serving in it again, then he probably won't be willing to give me the equipment I want.

S Context: Alfred often goes back and forth between careers, leaving one job only to return to it next year. Recently, he left his career as an engineer for something else. Alfred has always had a fascination with the military, and incidentally I'm looking for some used military equipment. I do know that he served in the military at some point in the past, although I'm not sure when that was. So, I thought:

If it's not the case that Alfred is serving in the military again, then he'll probably be willing to give me the equipment I want.

(iv)

EI Context: I'm about to start taking driving lessons and am looking for a good book on the subject. George is a person who likes acquiring new skills or refreshing old ones. I saw a book on driving in his library. I know that George is about to start taking lessons for something, although I don't know what. I have never seen George drive, and I don't know if he has ever taken driving lessons, but I thought:

If it's not the case that George is taking driving lessons again, and it is the case that he took driving lessons when he was 16, then he'll probably be willing to lend me this book.

If it's the case that George took driving lessons when he was 16, and it is not the case that he's taking driving lessons again, then he'll probably be willing to lend me this book.

If it's the case that George is taking driving lessons again, and it is the case that he took driving lessons when he was 16, then he probably won't be willing to lend me this book.

If it's the case that George took driving lessons when he was 16, and it is the case that he's taking driving lessons again, then he probably won't be willing to lend me this book.

S Context: I'm about to start taking driving lessons and am looking for a good book on the subject. George is a person who likes acquiring new skills or refreshing old ones. I saw a book on driving in his library. I know that George is about to start taking lessons for something, although I don't know what. I have never seen George drive, but I know that he has taken driving lessons, so I thought:

If it's not the case that George is taking driving lessons again, then he'll probably be willing to lend me this book.

(v)

EI Context: I'm looking for some used mountain climbing equipment. Karl likes sports and in fact he went on some extreme sports trip last summer. Now he's going on a second trip. I don't know if the last trip included mountain climbing, or even if Karl has ever done mountain climbing in the past, but I thought:

If it's not the case that on his upcoming trip Karl is going mountain climbing again, and it is the case that he went mountain climbing last summer, then he'll probably be willing to lend me the relevant gear.

If it is the case that Karl went mountain climbing last summer, and it's not the case that on his upcoming trip he's going mountain climbing again, then he'll probably be willing to lend me the relevant gear.

If it is the case that on his upcoming trip Karl is going mountain climbing again, and it is the case that he went mountain climbing last summer, then he probably won't be willing to lend me the relevant gear.

If it is the case that Karl went mountain climbing last summer, and it is the case that on his upcoming trip he's going mountain climbing again, then he probably won't be willing to lend me the relevant gear.

S Context: I'm looking for some used mountain climbing equipment. Karl likes sport and in fact he went on some extreme sports trip last summer. Now he's going on a second trip. I know that Karl's trip last summer involved mountain climbing, but I don't know what the current trip involves. So, I thought:

If it's not the case that on his upcoming trip Karl is going mountain climbing again, then he'll probably be able to lend me the relevant gear.

(vi)

EI Context: I want to start sailing in the Atlantic and I need to find maps with some of the easier routes indicated. Yosiane enjoys sea-related activities, and I remember that last year she vacationed in some cities on the coast of the Atlantic. This year she is taking another trip, although I'm not sure where. I don't know if her Atlantic trip was a sailing trip; in fact, I have no idea if she has ever gone sailing, but I thought:

If it's not the case that on her upcoming trip Yosiane is going sailing again, and it is the case that she went sailing in the Atlantic last year, then she'll probably be able to provide me with maps.

If it is the case that Yosiane went sailing in the Atlantic last year, and it's not the case that on her upcoming trip she's going sailing again, then she'll probably be able to provide me with maps.

If it is the case that on her upcoming trip Yosiane is going sailing again, and it is the case that she went sailing in the Atlantic last year, then she probably won't be able to provide me with maps.

If it is the case that Yosiane went sailing in the Atlantic last year, and it is the case that on her upcoming trip she's going sailing again, then she probably won't be able to provide me with maps.

S Context: I want to start sailing in the Atlantic and I need to find maps with some of the easier routes indicated. Yosiane enjoys sea-related activities, and I remember that last year she vacationed in some cities on the coast of the Atlantic. This year she is taking another trip, although I'm not sure where. I know that her Atlantic trip last year involved sailing, so I thought:

If it's not the case that on her upcoming trip Yosiane is going sailing again, then she'll probably be able to provide me with maps.

(vii)

EI Context: I want to try trout fishing, but I don't want to spend money on lures yet. So, I'm trying to find a more experienced fisherman to lend me some. Andrew likes the outdoors, and I know that he went camping by some creeks last fall, which is a prime time for trout-fishing. I know that he's planning another trip this fall, although I don't know what it involves. I actually don't know if Andrew has ever done any fishing, but I thought:

If it's not the case that on his upcoming trip Andrew is going fishing again, and he went trout fishing last fall, then he'll probably be able to provide me with lures.

If it is the case that Andrew went trout fishing last fall, and it's not the case that on his upcoming trip he's going fishing again, then he'll probably be able to provide me with lures.

If it is the case that on his upcoming trip Andrew is going fishing again, and it is the case that he went trout fishing last fall, then he probably won't be able to provide me with lures.

If it is the case that Andrew went trout fishing last fall, and it is the case that on his upcoming trip he's going fishing again, then he probably won't be able to provide me with lures.

S Context: I want to try trout fishing, but I don't want to spend a lot of money on lures yet. So, I'm trying to find a more experienced fisherman to lend me some. Andrew likes the outdoors, and I know that he went camping by some creeks last fall, which is a prime time for trout-fishing. I know that he's planning another trip this fall, and I also know that his trip last fall involved a lot of trout fishing. So, I thought:

If it's not the case that on his upcoming trip Andrew is going fishing again, then he'll probably be able to provide me with lures.

(viii)

EI Context: I want to start doing some reading on algorithmic complexity. I saw some books on the topic in Vera's library. I know that Vera recently shifted her research, and went back to some topics that she used to work on during her early career, although I'm not sure what. I have no idea if in past she ever worked on algorithms in particular, but I thought:

If it's not the case that Vera is working on algorithms again, and it is the case that she worked on algorithmic complexity back in the day, then she'll probably be able to lend me her books on the topic.

If it's the case that Vera worked on algorithmic complexity back in the day, and it is not the case that Vera is working on algorithms again, then she'll probably be able to lend me her books on the topic.

If it's the case that Vera is working on algorithms again, and it is the case that she worked on algorithmic complexity back in the day, then she probably won't be able to lend me her books on the topic.

If it's the case that Vera worked on algorithmic complexity back in the day, and it's the case that she is working on algorithms again, then she probably won't be able to lend me her books on the topic.

S Context: I want to start doing some reading on algorithmic complexity. I saw some books on the topic in Vera's library. I know that Vera recently shifted her research, and went back to some topics that she used to work on during her early career, although I'm not sure what. I know that one of her past research interests was algorithms, so I thought:

If it's not the case that Vera is working on algorithms again, then she'll probably be able to lend me her books on the topic.

(ix)

EI Context: Mary lives outside the city but likes to visit in order to go to the theater whenever there's a new show, often going twice to every show. The other day, I saw her in the city, shopping close to the theater. I have no idea if she's been to the new show so far, but I thought:

If it's not the case that Mary is going to the new show again, and it is the case that she went to it last week, then she's just in town for shopping today.

If it's the case that Mary went to the show last week, and it is not the case that she is going to it again, then she's just in town for shopping today.

If it's the case that Mary is going to the new show again, and it is the case that she went to it last week, then she isn't just in town shopping today.

If it's the case that Mary went to the show last week, and it is the case that she was going to it again, then she isn't just in town for shopping today.

S Context: Mary lives outside the city but likes to visit in order to go to the theater whenever there's a new show, often going twice to every show.The other day, I saw her in the city, shopping close to the theater. I know that she went to the new show once already, so I thought:

If it's not the case that Mary is going to the new show again, then she's just in town for shopping today.

(x)

EI Context: Mary had interests in music when she was younger and I know that for many years she was playing various string instruments, although I don't know which. Recently, I heard that after giving up on music while she was attending university, she has gone back to it, but has given up one of the string instruments she used to play. I'm looking to buy a used cello. I have no idea if Mary ever played the cello in particular, but I thought:

If it's not the case that Mary is playing the cello again, and it is the case that she used to play the cello when she was younger, then she will have an instrument for sale.

If it's the case that Mary used to play the cello when she was younger, and it is not the case that she's playing the cello again, then she will have an instrument for sale.

If it's the case that Mary is playing the cello again, and it is the case that she used to play the cello when she was younger, then she will not have an instrument for sale.

If it's the case that Mary used to play the cello when she was younger, and it is the case that she's playing the cello again, then she will not have an instrument for sale.

S Context: Mary had interests in music when she was younger and I know that for many years she was playing various string instruments, although I don't know which. Recently, I heard that after giving up on music while she was attending university, she has gone back to it, but has given up one of the string instruments she used to play. I'm looking to buy a used cello. I know the cello was one of the instruments that Mary played in the past, so I thought:

If it's not the case that Mary is playing the cello again, then she will have an instrument for sale.

(xi)

EI Context: I want to start doing some reading on Aristotelian ethics. I saw some books on the topic in Dan's library. I know that Dan changed his research recently, and went back to some older problems that he used to be interested in, but I'm not sure what he's working on now. I have no idea if in the past he ever worked on ethics in particular, but I thought:

If it's not the case that Dan is working on ethics again, and it is the case that he worked on Aristotelian ethics back in the day, then he'll probably be able to lend me his books on the topic.

If it's the case that Dan worked on Aristotelian ethics back in the day, and it is not the case that he is working on ethics again, then he'll probably be able to lend me his books on the topic.

If it's the case that Dan is working on ethics again, and it is the case that he worked on Aristotelian ethics back in the day, then he probably won't be able to lend me his books on the topic.

If it's the case that Dan worked on Aristotelian ethics back in the day, and it's the case that he is working on ethics again, then he probably won't be able to lend me his books on the topic.

S Context: I want to start doing some reading on Aristotelian ethics. I saw a book on the topic in Dan's library. I know that Dan changed his research recently, and went back to some older problems that he used to be interested in, but I'm not sure what he's working on now. I know that one of his past research interests was ethics, but I don't know if that is what he's doing now. So, I thought:

If it's not the case that Dan is working on ethics again, then he'll probably be able to lend me his books on the topic.

(xii)

EI Context: I'm interested in the history of theoretical linguistics. Ronnie is a historian of science and I saw some books on the topic in his library. I know that he changed his research recently, and went back to some older problems that he used to be interested in, but I'm not sure what he's working on now. I have no idea if previously he was ever researching the history of linguistics in particular, but I thought:

If it's not the case that Ronnie is researching the history of linguistics again, and it is the case that he researched the history of theoretical linguistics back in the day, then he'll probably be able to lend me his books on the topic.

If it's the case that Ronnie researched the history of theoretical linguistics back in the day, and it's not the case that he's researching the history of linguistics again, then he'll probably be able to lend me his books on the topic.

If it's the case that Ronnie is researching the history of linguistics again, and it is the case that he researched the history of theoretical linguistics back in the day, then he probably won't be able to lend me his books on the topic.

If it's the case that Ronnie researched the history of theoretical linguistics back in the day, and it is the case that he's researching the history of linguistics again, then he probably won't be able to lend me his books on the topic.

S Context: I'm interested in the history of theoretical linguistics. Ronnie is a historian of science and as a result owns books on the history of various disciplines. I know that he changed his research recently, and went back to some older problems that he used to be interested in, but I'm not sure what he's working on now. I know that one of his past research interests was the history of linguistics, so I thought:

If it's not the case that Ronnie is researching the history of linguistics again, then he'll probably be able to lend me books on the topic.

B.2.1. Fillers

B.2.2. Fillers

GoodCond:

1)

My friend Saul is a philosopher and has been working on a new theory for the past year. However, he has been very secretive about it. Yesterday he told me that he was almost done with the work, but given how secretive he has been I'm not sure whether he will publish it. So, I thought:

If Saul publishes his new theory, then that will make the other philosophers very excited.

2)

Ted has been in love with Robin for many months now and we have all been wondering whether or not he will do anything about this at some point. One day, Ted finally decided that he was going to ask her out. I'm not sure if Robin likes Ted back, so I thought:

If Ted asks Robin out and she says "no", then Ted will be crushed.

3)

John and Mary are avid theater goers and usually don't miss a performance. However, John cannot stand opera. This week the theater is putting on an opera by Wagner, but I'm not sure if John and Mary are aware of this. So I thought:

If John and Mary go to the theater this week, John will encounter a nasty surprise.

4)

My friend Ava was planning to go on vacation in the Netherlands. One day, I stopped by her house and I saw that the lights were on. I did not know her itinerary exactly and I wasn't sure if she was gone, so I thought:

If Ava has not left for her vacation yet, then maybe she has time to have a cup of tea with me.

5)

Rachel is a professor of mathematics. One day I stopped by her house and I saw that it was packed with books on algebra. I had a vague impression that her specialization was in geometry but I wasn't sure about this as she never really talked about her work. So I thought:

If Rachel specializes in algebra, then it makes sense that she has all these books.

6)

My friend Rob has spent some time in Russia but I don't know if he learned Russian while he was there. One day, I saw him browsing the Russian-language section in a bookstore. So I thought:

If Rob can speak Russian, then he must be looking for reading material.

7)

Christopher is participating in a treasure hunt. The clues take the form of math-based puzzles, which is not exactly Chistopher's strong point. So, I thought:

If Christopher finds the treasure, then that will be quite impressive.

8)

Stephen is taking part in a chess tournament. He's currently playing a game against a quite strong opponent. But if he wins, then he'll be up against much weaker players for the rest of the tournament. So, I thought:

If Stephen wins this game, then he'll have a good chance of finishing first in the tournament.

9)

Tom is going on a tour of France. I've always been fascinated by the small town of Tonnerre, which boasts a vast Karst spring called the "Fosse Dione". So, I thought:

If Tom passes through Tonnerre, then maybe he can bring me some water from the "Fosse Dione".

10)

Peter and I were dining at a restaurant last night. Peter disliked the food and was determined to ask for his money back. When he got up to do so, I thought: If Peter doesn't get his money back, he'll throw a tantrum.

11)

Me and Catherine are both geologists. I need some data on a glacier in Iceland. However, I'm very busy and cannot currently make the trip. I heard that Catherine might be visiting Iceland to survey one of the volcanoes there. So, I thought:

If Catherine visits Iceland, then maybe I can have her gather some data on the glacier.

12)

Daniel is a mathematician friend who works on number theory. One day he told me that he's secretly been working on the Riemann Hypothesis, one of the hardest unsolved problems in the field. So, I thought:

If Daniel solves the Riemann Hypothesis, he'll become famous overnight.

BadCond

1)

Ethan is on a trip and his first stop is England. His friend Olivia lives there and has invited him over for dinner during the days he'll be spending there. So, I thought:

If Ethan isn't coming to England, then Olivia will invite someone else for dinner.

2)

The Louvre has a new exhibition of medieval art. Melanie is an art critic and is in Paris to review the new exhibition. So I thought:

If Melanie isn't in Paris then something must have happened on her trip.

3)

My wife Joan is a doctor and she is often called away on various emergency visits. Tonight Joan was called away on such an emergency, and she told me she wouldn't be home. So I thought:

If Joan is home tonight, then we will be able to catch up on some TV.

4)

Alex was invited to give a talk at a conference in Athens, and I just saw him board the train to travel there. So I thought:

If Alex isn't on the train, then the organizers of the conference will be mad.

5)

My friend Helen has been writing a book, and recently she managed to find a publisher with whom she signed a contract. So, I thought:

If Helen isn't writing a book, then her publisher will take her to court.

6)

Peter met with his friend Abigail in the park yesterday. Afterwards, Peter went missing, and the police asked Abigail if she knew anything, since she was the last person to see him. So, I thought:

If Abigail didn't see Peter yesterday, then the police are grasping at straws.

7)

There's a new film at the cinema this week. Both me and Liam are interested in watching it. Liam had told me that he would go watch it yesterday. However, he ended up having to work late and couldn't go. I'm thinking of going to cinema tonight, so I thought:

If Liam went to the cinema yesterday, I should ask him what he thought of the film.

8)

Our math teacher gave us a very difficult problem as homework, and I wasn't able to solve it. Actually, no one in class had managed to tackle it, not even Theodore who usually excels at math. So, I thought:

If Theodore solved the problem, then I should ask him to help me.

9)

Charlotte is the understudy for Lady Macbeth's role in her school's production of "Macbeth". She wants to be on stage very much, but hasn't gotten a chance so far. Unfortunately, last night she also had to stay on the sidelines. So, I thought:

If Charlotte performed last night, I should ask her how it went.

10)

There was a robbery at the store where Sophia works. Sophia didn't see the thief, but the police still wanted to ask her a few questions. So, I thought:

If Sophia saw the thief, then maybe she can describe him to the police.

11)

We took a test at school the other day, and most of the class did poorly. However, Evelyn scored perfectly on it. So, I thought:

If Evelyn didn't do well on the test, then she must be very disappointed.

12)

The president was supposed to visit Oliver's school. Oliver was very excited to meet him. However, the visit was canceled at the last minute. So, I thought:

If Oliver met the president, then I wonder what he thought of him.

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