

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

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Abstract

We present experimental evidence that conjunction and disjunction differ in terms of presupposition projection. Presuppositions project asymmetrically from conjunction: a presupposition in the first conjunct projects regardless of any information in the second conjunct that could be used to satisfy the presupposition. We find no such an asymmetry for disjunction; it makes no difference whether or not the presupposition is in the first or the second disjunct; as long as there is one disjunct which carries information that can filter the presupposition, no projection occurs. These results strongly argue against accounts that take all projection to be asymmetrically determined by linear order in a uniform way across connectives. Instead, they support accounts of projection that can differentiate between conjunction and disjunction by modulating the effects of linear order through proper consideration of the underlying truth conditions of each connective.

1 Introduction

This paper is concerned with the differences between conjunction and disjunction with respect to presupposition projection. While 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. 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, whereas conjunction is genuinely asymmetric. This pattern has substantial theoretical repercussions, as it 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).

The paper is organised as follows: section 2 provides theoretical and empirical background on presupposition projection. First, we review the basic projection properties of the connectives, as well as previously considered evidence supporting asymmetry and symmetry respectively for conjunction and disjunction. We consider 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 approach of Mandelkern et al. (2020) in detail. Their paradigm proved particularly successful in testing the projection properties of conjunction, and showed that projection from conjunction is strongly asymmetric in a way that cannot be overridden. 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 directly that the two connectives indeed differ in terms of their projection properties. Section 4 looks at the theoretical implications of our results. Section 5 concludes.

2 Background

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 verb *continue* is generally taken to presuppose that whatever state (or activity) is being described as continuing was indeed something that held (or was going on) before the referenced time:

- (1) # John continues having research interests in Tolkien.

Uttering (1) in a context that supports no shared assumptions about John’s past research interests in Tolkien seems to give rise to some amount of infelicity.¹ We say that ‘continues having research interests’ presupposes ‘having had prior research interests’; the main new information that this contributes to an assertion is that of ‘having current research interests.’ The infelicity of (1), where the presupposition of ‘continue’ is not contextually supported, is then due ‘presupposition failure’. Now contrast (1) with (2) below:

- (2) I saw my old friend from college John the other day. We had done a research project on Tolkien together back then. To my surprise, he continues to have research interests in Tolkien.

In (2), the information that John had prior research interests in Tolkien is introduced

¹To varying extents, triggers allow global accommodation of the presupposed information, at least in certain cases; as this option is ruled out in our experimental designs through the use of so-called ‘explicit ignorance contexts,’ we do not dwell on this notion here.

explicitly before the sentence with *continue*, ensuring that the discourse context supports the presupposition; thus (2) is fully felicitous.

A key challenge in the literature on presupposition projection concerns the behavior of presuppositions in embedded contexts, e.g., in the scope of logical connectives. In some cases, the presupposition of an embedded clause seems to become a presupposition of the complex sentence as a whole, whereas in others, it doesn't - this is the 'projection problem' for presuppositions (Karttunen, 1973). A central projection pattern is that presuppositions project from the scope of negation:

(3) #John does not continue having research interests in Tolkien.

Just as its non-negated counterpart, (3) is infelicitous if uttered in a context that leaves open whether or not John had prior research interests in Tolkien. This pattern tells us that presuppositions are a different aspect of meaning from the assertion, as only the latter is targeted by negation. In (3), the assertion component, that John currently has research interests in Tolkien, is negated, and thus the sentence is False in a context where John used to, and currently continues having research interests in Tolkien (as is expected given the semantics of negation).

Another embedded environment from which presuppositions project is the antecedent of a conditional:

(4) #If John continues having research interests in Tolkien, then he will be able to help us.

Again, if it is not established in the context that John used to have research interests in Tolkien, infelicity arises.

Consider now the following contrast in conjunctions:

- (5) 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, (5-b), the sentence as a whole seems felicitous, even in absence of a supporting (extra-sentential) discourse context, in contrast to (1), suggesting that the sentence as a whole does not carry the presupposition introduced by *continue*. However, when the first conjunct contains the trigger and the second conjunct introduces the information supporting the presupposition, then infelicity ensues, (5-a).²

Recall that, intuitively, the presupposition trigger in (2) is felicitous because the presupposition is already entailed by the larger context in which the discussion is being

²The 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.

conducted, i.e., it is part of the common ground as the trigger is evaluated (Stalnaker (1974)). This intuition can easily be extended to the data in (5), as suggested by Stalnaker: As a hearer encounters (5-b), they first parse the first conjunct followed by ‘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 commonly assumed by the discourse participants). As they go on to parse the second conjunct, they thus can evaluate its presupposition relative to an updated global context that integrates the information of the first conjunct. That context entails that John had prior research interests in Tolkien, meaning the presupposition is supported and its use felicitous. Since the support in this case is introduced sentence-internally, the overall conjunctive sentence comes with no relevant constraints on the contexts it can be used in - the presupposition in the second conjunct gets ‘filtered’, in the terminology of Karttunen (1973). In contrast, in (5-a), the first conjunct gets parsed against the global context. In order to be felicitous, the presupposition about John’s prior research interests has to be entailed by that context as it gets evaluated. In other words, it projects, i.e., the conjunction as a whole carries the same presupposition as the simple sentence in (1). The second conjunct, which contains the presupposition, seems to ‘come too late’ to make a difference. Hence infelicity arises in absence of global contextual support of the presupposition.

Note that on this general view on the projection problem, 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 key generalization about presupposition projection can be stated as follows:

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

In (5-a), 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 (5-b) the local context is the initial global context plus the information contained in the first conjunct. Since in the case at hand, the first conjunct alone ensures that the presupposition is supported, no constraints are placed on the global contexts, as the presupposition is guaranteed to be felicitous in any global context.

As the contrast between (5-a) and (5-b) 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 a listener and can be added to the common ground (where appropriate). As this information becomes available from ‘left-to-right’, the resulting notion of local contexts is inherently an asymmetric one, at least in the account of conjunction sketched above: 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 more generally.

Turning to disjunction, we observe first that a presupposition in the second disjunct is filtered if **the negation of the first disjunct entails the presupposition**. No infelicity arises in (7):

- (7) 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, (8) is not felt to presuppose that John used to have research interests in Tolkien. (This was first observed in Partee’s so-called ‘bathroom sentences’.³)

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

Leaving aside 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.

The experimental investigation of this apparent contrast and the theoretical question it gives rise to is the central concern of our paper. 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 based on processing considerations. The second account is that of Hirsch & Hackl (2014),

³The prototypical ‘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.

which brings in the mechanism of ‘local accommodation’ (introduced below) to account for apparent cases of symmetric filtering. Since both accounts are framed in terms of the Local Context theory of Schlenker (2009), we spell out its relevant details first.

2.2 Symmetry and Asymmetry with Disjunction

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 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 (1983) put forward a semantic approach that was more powerful. This, in turn, faced criticism, whose first instances are attributed to Soames and Rooth, of 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 that ensures explanatory adequacy. Since Schlenker’s tools and ideas find their way into the ‘Limited Symmetry’ system we end up considering later in this paper (see section 4), it is worth going through his theory in some detail.

Following the standard Stalnakerian tradition, we will be thinking of contexts as sets of possible worlds, i.e. those worlds that are live options for being the actual one at a certain point in the 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 in which the truth value of the complex sentence overall is not already determined by other parts of the sentence. How precisely this plays out will, of course, depend on the truth-functional properties of the connective in question, which ultimately accounts for differences in local contexts, e.g., with conjunction involving consideration of information of another conjunct, whereas disjunction requires consideration of the negation of another disjunct.

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' , $C \models a(r \text{ and } D)b' \leftrightarrow a(D)b'$.

The idea is to not bother considering worlds already settled 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 all C -worlds based on the information contained in a : one limits attention to worlds where the truth value of the entire sentence has already been determined based on 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' , $C \models (\mathbf{p \text{ and } (r \text{ and } D)}\mathbf{b'}) \leftrightarrow (\mathbf{p \text{ and } (D)}\mathbf{b'})$. 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) narrows down the C -worlds relative to which q should be evaluated. Could we narrow it down further, or is ${}^c p$ the strongest restriction we can consider? 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 , $C \models (\mathbf{p \text{ and } D}) \leftrightarrow (\mathbf{p \text{ and } (r \text{ and } D)})$. Any such restriction will be too strong, and thus the proposition we are looking for cannot be stronger than ${}^c p$.

On an intuitive level, this captures the idea that the local context is the set of worlds where the truth value of the constituent under current consideration (here q) matters: the context worlds where the first conjunct is True, and only those, do matter, since these are the only worlds where the truth value of q affects the truth value of the conjunction. In worlds where the first conjunct is already False, the whole conjunction is False regardless of q . 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 (6). 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 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. Consider (9), repeated from (7) above:

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

The negation of the first disjunct entails that John has had prior research interests in Tolkien thus the condition in (6) is met. This is in line with the intuition that no infelicity due to the presupposition of *continue* arises here for the disjunctive sentence as a whole.

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 is false even though either p or q (and possibly both) are true in them. 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. As a consequence, presuppositions are predicted to uniformly project from a first disjunct, as its local context is simply the global context, and any such presuppositions must be entailed by the latter for the constraint in (6) to be met. However, as discussed in the previous section, this prediction does not seem to be borne out. (10), repeated from (8) above, does not seem to give rise to any infelicity based on the presupposition in the first disjunct:

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

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 (10) 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 , $C \models a(r \text{ and } D)b \leftrightarrow a(D)b$.

By virtue of no longer quantifying over all possible completions b' , we now have access to the actual sentence completion b 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 a corresponds to the parenthesis (, **p** corresponds to $_$, and **q** corresponds to b – thus will not include C -worlds where q holds, as their fate is already determined by the actual completion, so 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 . Allowing the use of the symmetric local context definition accounts for the felicity of (10) by assuming that right-to-left filtering is operative here, parallel to left-to-right filtering.

While the introduction of symmetric local contexts accounts for the felicity of (10), 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, and that the availability of the symmetric version is 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. This approach maintains a role for left-to-right parsing in projection, even if a somewhat weakened one, and crucially it still posits one general mechanism (or set of mechanisms) for projection from complex sentences, without needing to specify any particular projection properties in the lexical entries of individual connectives. This general nature of the mechanisms behind projection furthermore makes several key predictions: First, there should be measurable reflexes of the processing costs posited for the use of symmetric local contexts; in other words, (10) should be harder to process than (9).

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 (10), then the same should go for conjunction in (5-a), 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 (5-a) 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 (10) in a theory based on asymmetric local contexts.

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 (8) in terms of right-to-left filtering, they suggest an alternative way of deriving the absence of a global presupposition. Since they assume that filtering does follow parsing in proceeding from left-to-right, the presupposition in the first disjunct does project, at least initially. However, this interpretation ends up being discarded due to the application of local accommodation, which they argue is triggered on the basis of general pragmatic considerations associated with disjunctions.

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 (11):

- (11) 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, i.e. the speaker must not think that only ‘Sue went to the cinema’ or only ‘Sue went to the department store’ is true. 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:

- (12) 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 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 inter-

locutor diverge (Lewis, 1979). It comes in two varieties: global accommodation, where information is added to the global common ground, and local accommodation (Heim, 1983). 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:

(13) 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, the sentence in (13) 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 as a presupposition to the local context, meaning that it will behave just like asserted content in terms of being affected by embedding operators. 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, 1983; Beaver & Krahmer, 2001), this level of detail suffices for our purposes. By providing a way to avoid projection, local accommodation comes to the rescue in bathroom disjunctions as it helps to avoid the clash with NO that would arise if the presupposition were accommodated globally; effectively, it results in an interpretation that can be paraphrased as follows:

(14) 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 involves local accommodation to avoid the clash with NO. Under the assumption that local accommodation comes at a processing cost, the version with the trigger in the first disjunct is assumed to come 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 in this regard, which posits additional processing costs for symmetric filtering.⁴

⁴Note that Hirsch & Hackl (2014) report experimental data from binary 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 11.

2.3 Experimental Background: Asymmetry in Conjunction

We wish to investigate the (a)-symmetry of disjunction experimentally. To do so, we build on prior paradigms investigating related issues. In particular, we adapt 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). The key target sentences are illustrated using the emotive factive trigger *happy* (which presupposes its complement clause to be true):

- (15) a. 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.
- b. PS-SECOND (A conjunction with a presuppositional second conjunct, and a first conjunct that entailed the presupposition 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. This embedding is necessary in the case of conjunction, as parallel unembedded cases would not make it possible to tease apart acceptability due to global accommodation from acceptability due to right-to-left filtering. Embedding the conjunction in the antecedent of a conditionals - an environment from which presuppositions standardly project -, does differentiate these two cases: A globally accommodated presupposition would project. In contrast, if the presupposition were filtered (right-to-left) by the following conjunct, it should not have any impact on the global context. **(ii)** the presupposition-bearing conjunct asymmetrically entails the presupposition-less conjunct, to avoid a potential confound of redundancy (Rothschild, 2011).⁵

In order to measure the differential acceptability based on the interpretive options

⁵As we depart from this in our experiment 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 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.

for the sentence in question, target sentences were preceded by two different types of contexts: an explicit ignorance context (EI, Abusch 2010), which explicitly asserts that the presupposed proposition was not settled by the context; and a support context (S), which explicitly supported the presupposition.

- (16) 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 the interpretation of **PsFirst** involves global accommodation of the presupposition, then it 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 presuppose that p in the following sentence. No such issue arises in the **Support** context. In contrast, if right-to-left filtering is an option, it should be acceptable. 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). 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:

- (17) COND-PS⁶ (A simple presuppositional sentence):
 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 COND-PS based on that. PSCOND also controls for potential (presumably limited) availability of local accommodation inside of the *if*-clause, as this is the only remedy for making this sentence acceptable in the Explicit Ignorance context (which should be equally available in PSFIRST).

Furthermore, to control for potential conjunct-order effects independent of the key presuppositional properties, non-presuppositional controls corresponding to either conjunct order were included as well:

- (18) a. NO-PS-FIRST (A conjunction like the one in PS-FIRST, 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. NO-PS-SECOND (A conjunction like the one in PS-SECOND, but with no presupposition in the second conjunct):
 If Jacob is in Paris and Emily was hoping that he is in France, then she

⁶This is called SIMPLE-PS in Mandelkern et al. (2020), but we adjusted it to match our own condition names below.

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 PS-FIRST sentence is less acceptable than PSSECOND in an EI context. While there is a slight order effect in the non-presuppositional control conjunctions as well, it is much stronger in the presuppositional case (as reflected in 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).

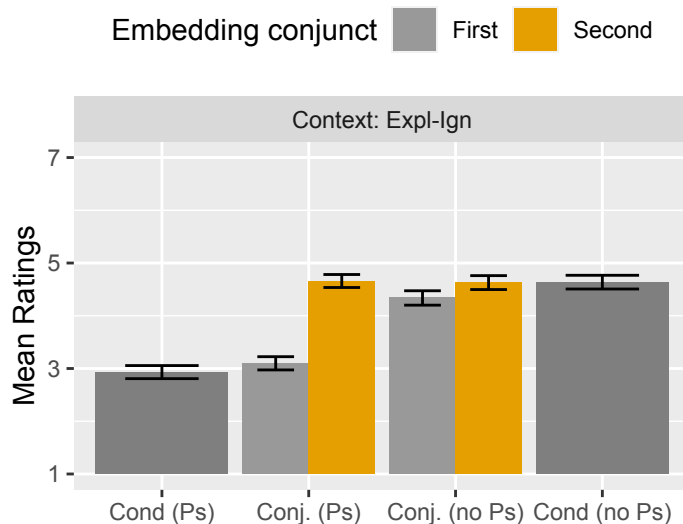


Figure 1: Mean acceptability for each condition in Mandelkern et al. (2020)

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, comprehenders would be expected to resort to it, even if it comes at a cost. But note that the acceptability of the PS-FIRST sentences in EI contexts is just as low as that of the COND-PS sentences, where the only mechanism that allows a COND-PS sentence to be acceptable in an EI context is local accommodation. Thus, the fact that the acceptability of PS-FIRST sentences parallels that of COND-PS sentences in EI contexts is evidence that right-to-left filtering is not available at all in PS-FIRST 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?

3 Experiments on (a-)symmetry in Disjunction

3.1 Experiment 1: Symmetry in Disjunction

3.1.1 Design

Our first experiment is 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. 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 PS-FIRST vs. PS-SECOND conditions are instances of ‘bathroom disjunctions’, as illustrated in (19)-(20): 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):

- (19) 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. (PS-FIRST)
- (20) 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. (PS-SECOND)

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.⁷ These disjunctions were presented in Explicit Ignorance contexts, to

⁷On 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.

measure potential impact of a globally projected interpretation of the presupposition on acceptability, as in the Mandelkern et al. design.

- (21) **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 control variants (NO-PS), (22)-(23) to control for potential order effects on acceptability that are orthogonal to presupposition projection. Thus, we had the following two-level factors: ORDER (FIRST vs SECOND) and PS (PS vs NO-PS). This means that presupposition-related order effects in the critical conditions (PS), above and beyond these control conditions (NO-PS), would be evidenced by an interaction between ORDER and PS. These controls were also presented in the Explicit Ignorance context.

- (22) 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)
- (23) 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)

A final set of controls was provided by conditionals with simple (non-coordinated) antecedents containing a presupposition (COND-PS), (24):

- (24) If John continues having research interests in Tolkien, then that’s why he is reading ‘The Fellowship’. (COND-PS)

These were presented both in Explicit Ignorance (EI) contexts and additionally in a Support (S) context, where the presupposition was already globally established. They provide baselines for the acceptability of local accommodation relative to presuppositional support (again as in Mandelkern et al.).

- (25) **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) closely, there are several substantial differences:

- (26) 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 CONDPs control)
- e. No fillers

Starting with (a), our target disjunctions in the (NO-)PS-FIRST/SECOND conditions were not embedded in the antecedent of a conditional, as sentences following that pattern quickly get excessively complex and hard to evaluate. 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, as 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 (7) 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. More importantly, participants would likely become sensitive to the particular nature of the stimuli even more quickly than in other cases if they keep seeing many repeated variants of the bathroom sentence pattern. This runs the risk of leading to the adoption of task-specific strategies, which could muddy the waters with regards to interpreting outcome measures. To minimize such risks, we opted 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.

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 the only condition for which we used the SUPPORT context is COND-PS, as it is infelicitous to assert a bathroom disjunction in a context that explicitly supports the presupposition:

- (27) (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 NO-PS-FIRST and NO-PS-SECOND 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 based on our choice to just 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.

3.1.2 Predictions

Recall the main competing accounts of the projection phenomena observed for disjunction, specifically in bathroom sentences: First, projection from disjunction might be entirely symmetric (cf. conjunction), without any associated costs. Alternatively, we reviewed two accounts that do posit some level of asymmetry at one level or another:

- (28) **Schlenker (2009)**: Symmetric filtering is possible in a ‘bathroom disjunction’, but associated with a processing cost, due to a processing preference for asymmetric projection.
- (29) **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 findings).

Both accounts thus posit an asymmetry of one sort or another between PS-FIRST and PS-SECOND, which is associated with a processing cost that is standardly going to be assumed to be reflected in decreased acceptability in an acceptability judgment task: Under the Schlenker (2009) view this comes about because resorting to right-to-left filtering is a departure from the left-to-right processing default and incurs a cost. For Hirsch & Hackl (2014), PS-FIRST requires the use of local accommodation (while PS-SECOND does not), which also incurs a processing cost. 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 NO-PS-FIRST/SECOND conditions. Thus, both accounts predict that PS-FIRST and PS-SECOND should differ in acceptability to a greater extent than NO-PS-FIRST and NO-PS-SECOND. In other words, both views predict an interaction between ORDER and PS.

There is furthermore a prediction specific to the local accommodation view. The

PS-FIRST and COND-PS 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 (there could, of course, be other differences in acceptability reflecting, e.g., their difference in complexity). At the same time, the PS-SECOND and COND-PS sentences in SUPPORT contexts are parallel in that in both cases, preceding material (either in the local context, in the case of PS-SECOND, or in the global context, in the case of COND-PS sentences in SUPPORT contexts) ensures that the presupposition is entailed in the respective local contexts; so, both the COND-PS sentences in SUPPORT contexts and the PS-SECOND 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 (COND-PS in Explicit Ignorance Context and Ps-First), and the conditions where the presupposition is supported in its local context (COND-PS in Support and PS-SECOND).

3.1.3 Participants & Procedure

255 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 COND-PS 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 and the csv-file containing the full stimuli are accessible at <https://farm.pcibex.net/r/bMqAbG/>.⁸

3.1.4 Results

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

We conducted two sets of statistical analyses to assess the theoretically relevant hypotheses. First, we fit a mixed effect logistic regression model with a 2×2 interaction for the disjunction conditions. The factors PS and ORDER were sum-coded, and the model included random intercepts for both participants and items as well as an uncorrelated random effect slope for PS by items.⁹ There were no significant effects, as detailed in Table 1 (*p*-values estimated using the Satterthwaite method via the `lmerTest` package in R).

⁸Click 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)

⁹Since participants only saw two items per factor level, by-participant random effect slopes could not sensibly be included. Including a random effect slope for ORDER by item yielded a singular fit warning (the model remained unchanged). Including the random slope for PS significantly improved overall model-fit, as confirmed by a likelihood ratio test via model comparison ($\chi^2 = 34.3, p < .001$).

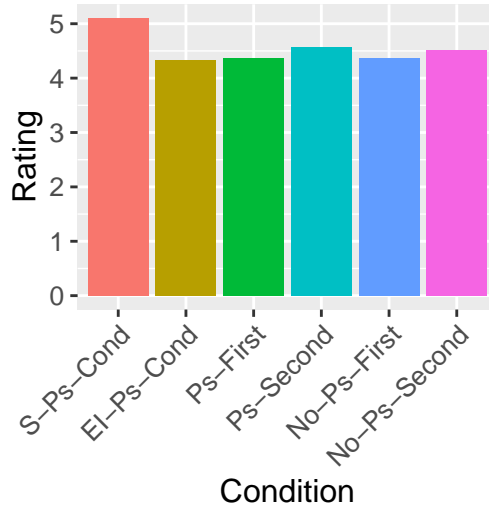


Figure 2: Mean acceptability by condition

	Coeff.	SE	t	p
PS	0.00005	0.39	0	1
ORDER	0.164	0.11	1.429	.153
PS * ORDER	0.142	0.23	0.617	0.538

Table 1: (NO-)PS \times ORDER Mixed-effect model summary

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 on ratings for either PS ($\beta = -0.093$, $t = -0.574$, $p = 1$) or NOPs ($\beta = -0.235$, $t = -1.445$, $p = 0.30$). In sum, we find no support for the ORDER \times (NO-)PS interaction predicted by asymmetric accounts, nor any effects of order for either the PS or NO-PS conditions.

Next, we fit a mixed effect logistic 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 PRIOR-SUPPORT was set up, with the EI-PS-COND and PS-FIRST conditions coded as NO-PRIOR-SUPPORT, and S-PS-COND and PS-SECOND as PRIOR-SUPPORT (since the latter two both involve support of the presupposition in the preceding context, assuming standard left-to-right filtering). The second factor was EMBEDDING, with the levels COND and DISJ. Both factors were sum-coded, and a first model including random intercepts for both participants and items as well as an uncorrelated random

effect slope for both factors was fitted using *lmer* in R.¹⁰ Based on model comparisons using likelihood-ratio tests, inclusion of the random effect slope for PRIOR-SUPPORT did not improve model fit ($\chi^2 = 0.03, p = .86$), in contrast to the one for EMBEDDING ($\chi^2 = 31.8, p < .001$), so we simplified the random effect structure to only include the latter. As shown in Table 2, there was a significant interaction, as well as a significant effect of PRIOR-SUPPORT (dominated by the interaction, as detailed below) (p -values again estimated using the Satterthwaite method via the *lmerTest* package in R).

	Coeff.	SE	t	p
EMBEDDING	-0.258	0.42	-0.61	.57
PRIOR-SUPPORT	-0.465	0.13	-3.72	<.001
EMBEDDING * PRIOR-SUPPORT	0.738	0.25	2.951	<0.01

Table 2: PRIORSUPPORT \times EMBEDDING Mixed-effect model summary

To further investigate the nature of the interaction, we conducted planned comparisons to separately test for effects of PRIOR-SUPPORT at the COND and DISJ levels of the EMBEDDING factor, using the *emmeans* package with Bonferroni-corrected p -values. PRIOR-SUPPORT had a significant effect on ratings for COND ($\beta = -0.83, t = -4.31, p < .01$), but - in line with the same comparison in the (NO-)PS \times ORDER analysis above - not for DISJ ($\beta = -0.098, t = -0.51, p = 1$). The main effect of PRIOR-SUPPORT 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 PRIOR-SUPPORT and EMBEDDING - as both EI-PS-COND and PS-FIRST 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 PRIOR-SUPPORT provides crucial evidence for the validity, sensitivity, and power of our experiment, in that we are able to find effects based on the relation of the linguistic context to an embedded occurrence of a presupposition trigger. 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.

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 PS-FIRST disjunctions (costly right-to-left filtering for the former, local accommodation for the latter). Thus, the lack of an interaction between (NO)-PS and ORDER

¹⁰Again, since participants only saw two items per factor level, by-participant random effect slopes could not sensibly be included. Including a random effect slope for the interaction led to convergence failure.

(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 PRIOR-SUPPORT should have parallel effects in the COND and the DISJ conditions, meaning there should be no interaction between PRIOR-SUPPORT and ORDER, is directly refuted by our results, as we do find such an interaction.

The picture that emerges from our data is that PS-FIRST and PS-SECOND 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 NO-PS controls. In this respect, our results stand in stark contrast to the findings for conjunction in Mandelkern et al. (2020), where their conjunctive PS-FIRST was found to be significantly less acceptable than the PS-SECOND counterpart and NO-PS controls.¹¹ 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 PS-FIRST and PS-SECOND 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. We will turn to more detailed considerations of the theoretical implications of these findings in section 4. Before doing so, we turn to a second experiment that provides a more direct comparison between conjunction and disjunction in a single experiment.

3.2 Experiment 2: ‘and’ vs ‘or’

3.2.1 Design

Our first experiment did not find any order-based asymmetry in filtering presuppositions in disjunction, in stark contrast to the results for conjunction in Mandelkern et al. However, while we followed the same general paradigm, there were some differences in implementation, and moreover, to draw any firm conclusion that disjunction really is different from conjunction in this respect, it would be ideal to have a more direct comparison within one experiment. Our second experiment aims to provide such a direct comparison, as we combine the Mandelkern et al. design for conjunction and our own design for disjunction into a single experiment.

We created items using the same 6 triggers (*continue, again, aware, happy, stop,*

¹¹While 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.

find out) as in Experiment 1, with parallel 6 condition variations implemented for each connective (CONJ vs. DISJ). To further maximize uniformity of stimuli while avoiding embedding of disjunctions in an *if*-clause, presupposition triggers appeared in the scope of the possibility modal *could*. This plays the same conceptual role for presupposition projection as the embedding in IF-clauses in the Mandelkern et al. study, in that it allows us to dissociate filtering from global accommodation in conjunctions, and it also makes the disjunction stimuli entirely parallel to the conjunction stimuli.

Similarly to the COND conditions in Experiment 1, we used simple (i.e., not coordinated) sentences with the presupposition trigger embedded in the scope of ‘could’, in Support (S) and Explicit Ignorance (EI) contexts as controls. These established baselines for presupposition projection and presuppositional support:

- (30) **Contexts:** 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. I tried to figure out why that book was there.
- a. I know that John had research interests in Tolkien in the past, ... (S)
- b. I don’t know if he ever did have interests in Tolkien,... (EI)
- ...so I thought:
- (31) It could be the case that John continues having research interests in Tolkien, so that’s why he’s reading the book. (SIMPLE-PS)

The critical target sentences were conjunctions and disjunctions, embedded under ‘could’, with the presupposition introduced in either the first (PS-FIRST) or the second (PS-SECOND) disjunct or conjunct:

- (32) **Disj:**
- a. It could be the case that either John continues having research interests in Tolkien or he never used to have such interests, so I should ask him why he’s reading this book. (PS-FIRST)
- b. It could be the case that either John never used to have research interests in Tolkien or he continues having such interests, so I should ask him why he’s reading this book. (PS-SECOND)
- (33) **Conj:**
- a. It could be the case that John continues having research interests in Tolkien and used to have research interests in Tolkien’s fantasy writings, so he is reading the book for work. (PS-FIRST)
- b. It could be the case that John used to have research interests in Tolkien’s fantasy writings and continues having research interests in Tolkien, so he is reading the book for work. (PS-SECOND)

As before, for each presuppositional sentence, we include a non-presuppositional version (CONJ/DISJ-NO-PS-FIRST/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 PS-FIRST relative to PS-SECOND that exceed any parallel decreases for the NO-PS variants.

- (34) DISJ:
- a. It could be the case that either John currently has research interests in Tolkien or he never used to have such interests, so I should ask him why he's reading this book. (NO-PS-FIRST)
 - b. It could be the case that either John never used to have research interests in Tolkien or he currently has such interests, so I should ask him why he's reading this book. (NO-PS-SECOND)
- (35) CONJ:
- a. It could be the case that John currently has research interests in Tolkien and used to have research interests in Tolkien's fantasy writings, so he is reading the book for work. (NO-PS-FIRST)
 - b. It could be the case that John used to have research interests in Tolkien's fantasy writings and currently has research interests in Tolkien, so he is reading the book for work. (NO-PS-SECOND)

This design follows exactly the same overall logic as our first experiment and the Mandelkern et al. study. However, we have minimized differences between the conjunction and disjunction stimuli apart from the connective: 1) Both conjunctions and disjunctions are embedded in the scope of the possibility modal *could* (as opposed to *if*-clauses in Mandelkern et al. and no embedding in our Experiment 1). 2) The disjunctions now do not include the extra conjunct that they carried in Experiment 1, which helped with overall discourse felicity but could in principle give rise to worries about filtering on purely formal grounds (see footnote 7 on why we don't think this gives rise to any real issues). This simplification also helped to balance overall complexity of the stimuli in light of the added embedding under *could*. As an alternative approach to improving felicity in some disjunctions, the phrase 'in the first place' was added in the second disjunct, (see the links provided in section 3.3.3 for demonstration versions of the experiment, including the csv-files containing the stimuli), which intuitively increased felicity by providing some justification for the presence of the second disjunct. 3) Finally, to maximize the similarity with the Mandelkern et al. study, as well as to distract participants from the critical items, we included fillers. A difference that remained between the connectives, however, was that in conjunctions, the non-presuppositional conjunct asymmetrically entails the presuppositional conjunct, while in the corresponding disjunctions, the negation of the other disjunct was equivalent to the presupposition (see section 3.2.1 for discussion of this general issue with 'bathroom'-style disjunctions).

Three types of fillers were included, illustrated in (36)-(38), with 6 items respectively for the FALSE-FILLER and COND types (3 Good and 3 Bad).

- (36) a. **Context:** 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:
- b. It could be false that Ava has gone on her vacation, so she might have time to have a cup of tea with me. (FALSE-FILLER)
- (37) 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. (BAD-COND)
- (38) 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. (GOOD-COND)

The False-Fillers item were simple (i.e., non-coordinated) sentences embedded under 'It could be false'. There is nothing technically wrong with these sentences, but the presence of 'false' adds some complexity, which could lead to decreased acceptability. Their purpose was to counterbalance the fact that all the critical sentences were embedded under 'It could be the case'.

The GOOD/BAD-COND 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 GOOD-COND fillers, this requirement was fulfilled, while in BAD-COND fillers, it was not. By introducing another source of infelicity in the items that are presented, these pairs are aimed towards distracting the participants from picking up that we are testing the potential effects of projection in the critical items. Furthermore, as we rely on detecting acceptability effects based on fairly subtle interpretive properties of relatively complex and long sentences, we use these to provide an exclusion criterion in our data analysis (as detailed below): if a participant is not picking up on the (arguably less subtle) GOOD-COND vs. BAD-COND contrast, then this is an indication that their judgments are not calibrated at the right level of subtlety to be sensitive to our critical presupposition manipulations.

3.2.2 Predictions

Accounts that take projection to be uniformly asymmetric across connectives predict that PS-FIRST should be worse than PS-SECOND for both disjunctions and conjunctions, whereas no such difference should be found for the NO-PS conditions. If on the other hand projection properties differ by connective, with disjunction being symmetric and conjunction asymmetric, then we expect that there will be no advantage of DISJ-PS-SECOND over DISJ-PS-FIRST (as observed in Experiment 1), but there should

be a difference between CONJ-PS-FIRST and CONJ-PS-SECOND (as in Mandelkern et al). In a direct comparison of the connectives, this would also crucially predict an interaction between ORDER and CONNECTIVE in the PS conditions.

3.2.3 Participants & Procedure

A total of 552 participants were recruited from Prolific and our university’s subject pool.¹² After seeing informed consent, they saw a list of experimental items with one item per trigger and condition, counterbalanced in a Latin square design, with Connective (DISJ vs. CONJ) as a between subjects factor, along with 12 fillers (18 items total). The full set of items was shown in randomized order. The task was to indicate on a 9-point scale how natural the sentence sounds in the given context.¹³ A demonstration version of the experiment as well as the underlying code and the csv-files containing the full stimuli are accessible at <https://farm.pcibex.net/r/khsLsR/> (for conjunction) and <https://farm.pcibex.net/r/BpVBkN/> (for disjunction).

3.2.4 Results

Data Treatment. Since Experiment 2 included filler items that allowed for an independent assessment of participants’ attentiveness and sensitivity to the general contextual considerations bearing on the task, namely GOODCOND (38) and BADCOND (37), we first analyzed participants’ performance here. Looking at all participants’ data, there was a clear and significant difference between the two types, confirmed by a mixed effect linear regression model with random intercepts for participants and items, as well as a random slope for filler type, the maximal model supported by the design, since filler type was manipulated between items ($\beta = 4.1$, $SE = 0.82$, $t = 4.99$, $p < .01$).¹⁴ However, there naturally was variation among participants in the extent of the mean difference in ratings between GOODCOND and BADCOND. Furthermore, the means of the SIMPLE-PS control conditions differed to a much smaller extent in the full data, by about one point on the rating scale (SUPPORT: 7.43; EXPLICITIGNORANCE: 6.44). In light of this, and the even smaller differences, if any, in the critical conditions in Experiment 1, we decided to remove all participants with a mean difference between GOODCOND and BADCOND of less than 3. This affected 161 participants, or about 29.2% of our data, leaving us with data from 391 participants’ data.¹⁵ Given both the mean difference for these fillers overall, and the intuitively clear contrast, we think it

¹²After starting data collection on the latter, it quickly became clear that there was not sufficient supply of participants there at the time, and the subject pool ultimately only yielded 53 participants; the remaining 499 participants were recruited on Prolific.

¹³We decided to use a 9-point scale, as the differences we are after are fairly subtle, in the hope of a more fine-grained scale providing more space for small differences to come out.

¹⁴We’re following the same analysis approach here as for Experiment 1, reporting p -values from `lmerTest`.

¹⁵See Figure 5 in Appendix for histogram of the overall filler difference distribution.

most prudent to take the loss in statistical power in turn for having reasonable assurance that the data we analyze comes from participants who made a clear-cut distinction in their ratings on a completely independent, and much less subtle, measure.

Simple-PS Turning to the control conditions (without filtering at stake), we first test whether the sensitivity to the filler contrast that we based our removal criterion on systematically corresponds to performance on the control condition, by running a simple regression predicting the difference between SUPPORT and EXPLICIT IGNORANCE from the difference between GOODCOND and BADCOND, calculated by participant.¹⁶ SIMPLEPS differences by context systematically get larger as participants' mean difference between the fillers gets larger ($\beta = 1.05$, $SE = .15$, $t = 7.06$, $p < .001$). This confirms that focusing on data from participants seeing a clear difference between fillers homes in on participants that are similarly more sensitive to the manipulation of presuppositional support in context.

Conj vs. Disj This brings us to our central concern, namely whether CONJ and DISJ differ in the way that linear order (introduction of the presupposition in the FIRST or SECOND conjunct) affects felicity in EI contexts. The overall descriptive pattern in mean ratings is illustrated in Fig. 3. To test the apparent effect in opposite directions statistically, we fit a linear mixed effect model to the PS conditions, with ORDER and CONJ vs. DISJ as interacting fixed effects (using sum-coding), and random intercepts for participants and items, as well as a random slope for coordination type by Items (the maximal random effect structure for which the model would converge). There was a significant interaction ($\beta = .89$, $SE = .30$, $t = 2.95$, $p < .01$), as well as a significant main effect of coordination type with higher ratings for conjunction ($\beta = .136$, $SE = .30$, $t = 4.46$, $p < .01$). Planned comparisons for the effect of ORDER for each coordination type calculated using the `emmeans` package revealed the interaction to be driven by significant simple effects of order in opposite directions (FIRST-SECOND - DISJ: $\beta = 0.46$, $SE = .22$, $t = 2.12$, $p < .05$; CONJ: $\beta = -0.44$, $SE = .22$, $t = 2.03$, $p < .05$).

In light of potential similar effects for the NO-PS condition, illustrated in Fig. 4, we ran the same analyses on these. We find none of the relevant observed effects to be significant, i.e., no interaction ($\beta = .35$, $SE = .33$, $t = 1.04$, $p = 0.29$) and no simple effects of order (DISJ: ($\beta = .11$, $SE = .24$, $t = 0.45$, $p = .65$; CONJ: ($\beta = -.24$, $SE = .24$, $t = 1.02$, $p = .31$)), but only a main effect of coordination type, with conjunctions rated higher than disjunctions, as above ($\beta = .82$, $SE = .26$, $t = 3.17$, $p < .01$). Thus, the observed effects for CONJ-PS and DISJ-PS seem to be due to the relation of the presuppositions to the Explicit Ignorance context: in particular, the effect of ORDER in such contexts lacking support of the presupposition differs for conjunction and disjunction, as was already indirectly suggested by the comparison of

¹⁶See Figures 6 and 7 in Appendix for a graphic visualizing this relationship.

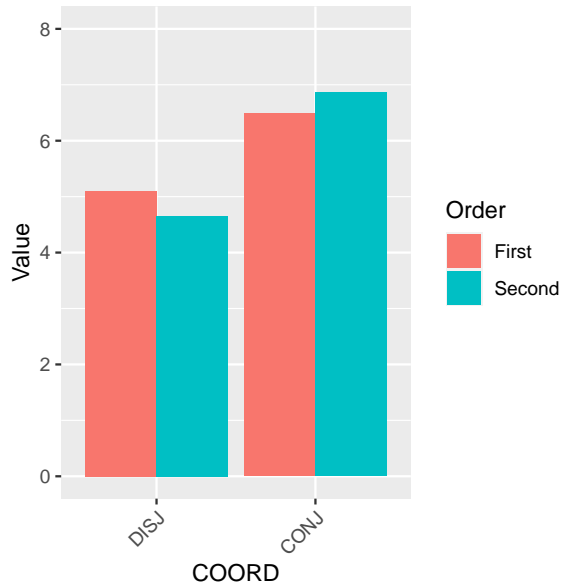


Figure 3: Mean acceptability by ORDER and Coordination type in PS conditions

Experiment 1 with the Mandelkern et al. results.¹⁷

3.2.5 Discussion

Experiment 2 clearly establishes that conjunction and disjunction are not the same in terms of their projection properties, specifically with regards to linear order. As in Mandelkern et al. conjunctions exhibit a PS-FIRST/SECOND contrast with an advantage for the latter, where the presupposition is supported by the *preceding* context. In contrast, the effect of linear order on projection from disjunction significantly differs from that of conjunction, as reflected in the significant interaction between ORDER and coordination type.

Somewhat unexpectedly, we in fact find a difference in the opposite direction for disjunction, with higher ratings for DISJ-PS-FIRST than DISJ-PS-SECOND. We do not think that this contrast should directly inform our theoretical discussion of projection (e.g., to consider that we have projection from PS-SECOND, but not from PS-FIRST): first, there is no theory of projection that predicts such a difference between a PS-FIRST disjunction and a PS-SECOND disjunction: even on an account that posits symmetric filtering for disjunction, the prediction is that PS-FIRST and PS-SECOND should be equal. Moreover, if this difference were due to projection, then we would expect that PS-SECOND should be worse when compared to NO-PS-SECOND - but they do not significantly differ, and in fact, the mean for the former is slightly higher (4.65 vs. 4.55). Thus, we are inclined to think that factors independent of presupposition are

¹⁷Parallel to the relationship between the GOODCOND vs. BADCOND difference and the support variants for SIMPLEPS, we also find a systematic relationship between the former and rating differences in the CONJ-PS conditions, but not in the DISJ-PS conditions. See Appendix for details.

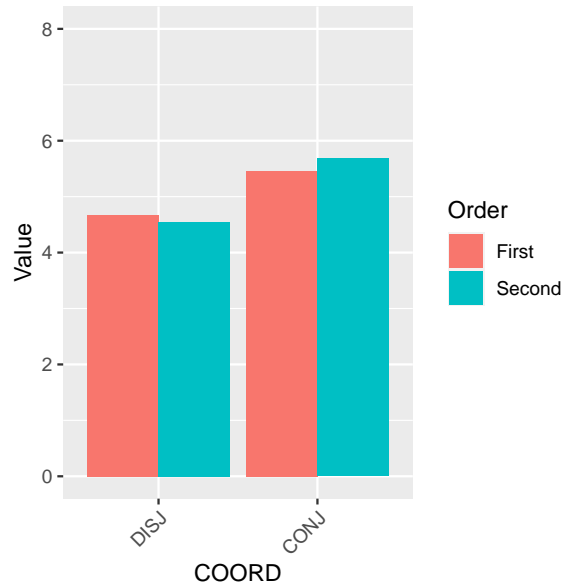


Figure 4: Mean acceptability by ORDER and Coordination type in NO-Ps conditions

responsible for this difference. One possibility is that the presence of ‘in the first place’ contributed to decreasing felicity when appearing in the first disjunct. Compare these conditions for ‘again’:

- (39) a. **Context:** My friend William researches the history of music and for the past few years he has been focusing on the history of woodwinds. One day, I stopped by his house and I saw a well-worn-out and heavily used book about the cello. I don’t know if William ever had an interest in stringed instruments, so I thought:
- b. It could be the case that either William is getting interested in the history of stringed instruments again or he never had such interests in the first place, so I should ask him why he’s reading this book. (PS-FIRST)
- c. It could be the case that either William never had interests in the history of stringed instruments in the first place or he is getting interested in the history of stringed instruments again, so I should ask him why he’s reading this book. (PS-SECOND)

It seems that ‘in the first place’ is subject to a felicity constraint that demands some contrastive material to have been introduced in the preceding discourse. This happens in (39-b), but not in (39-c). Another (related) possibility is that disjunctions prefer to introduce what seems to be the default option in the first disjunct (see also Lassiter (2009)). In (39) above, the context creates a salient possibility that William has research interests in stringed instruments, and it might be preferable to address this positive possibility from the get-go in the first disjunct, rather than present its negation first. Future experimental forays into these issues should try to disentangle these

possibilities.

In sum, we take our results to support two conclusions: first, conjunction and disjunction differ in terms of the role that linear order plays for presupposition projection; second, for conjunction we have evidence for asymmetric projection behavior (Experiment 2, as well as the results of Mandelkern et al. (2020)), whereas for disjunction we find no evidence for a corresponding asymmetry in the theoretically relevant direction. We now turn to discussing the theoretical implications of these two points.

4 Theoretical Implications

4.1 Constraints on a Theory of Projection

To frame our overall discussion of theoretical implications of our findings, we start by considering the space of options that remains open in light of them. First, embracing the notion that projection from disjunction is symmetric, we are left with two options. **Option 1** is that in the case of disjunction, symmetric filtering is available **without incurring any extra cost** (at least none that is measurable in our task). This would capture the absence of any left-to-right asymmetry between PS-FIRST and PS-SECOND. It also explains why the NO-PS conditions are no better than the PS conditions.¹⁸

Option 2 is that genuine filtering is not at play in disjunction at all: Geurts (1999), for example, argues that presuppositions generally project from both disjuncts, yielding a different kind of symmetry. Absence of projection, e.g., in ‘bathroom’ disjunctions, then requires 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).

It is not clear that our data directly offer anything decisive for or against these two options. An advocate of Option 2 might allude to the comparable levels of acceptability of the PS-DISJ conditions (with either order) and EI-PS-COND (which requires local accommodation on any account) in Experiment 1, and the relatively even lower ratings for PS-DISJ in Experiment 2. However, the NO-PS conditions fare no better, making it likely that the reduced acceptability across the board for disjunction is due to its inherent complexity (both structurally and conceptually), with no special impact of presuppositional information and its relation to the context. (Furthermore, recall that in Experiment 2, we saw PS conditions having, if anything, slightly higher ratings than NO-PS for disjunction.)

Based on this latter set of comparisons, an advocate of Option 1 might indeed try to argue that there is no evidence for local accommodation costs that, all else being equal, would be predicted by Option 2, and thus speak in support of genuine, cost-free symmetric filtering. This line of argument doesn’t face any obvious counters from our

¹⁸In Experiment 2, the reverse may even hold, but presumably that is due to factors other than presuppositional support, as discussed above.

data, but in light of the EI-PS-COND comparison in Experiment 2, and the relative subtlety of effects in the coordination variants there (including for what we assume to be local accommodation for conjunction in the relevant PS-FIRST condition), we're reluctant to draw any firm conclusions in this regard. However, foreshadowing a point we are turning to next, we note here already that Option 2 has a clear disadvantage when considering the broader conceptual space, in that it does not seem compatible with a general and explanatory approach to projection, in the spirit of Schlenker (2009), in contrast to Option 1 (see Section 4.4).

On a more general level that leaves the choice between these options open for now, it is important to note that neither option is compatible with a domain general projection mechanism that treats conjunction and disjunction **uniformly** w.r.t. effects of linear order. In other words, based on our results, any theory of projection needs to differentiate conjunction and disjunction in terms of projection, either by hard-wiring the projection properties into the lexical entries of the connectives, or by identifying distinct lexical properties of the connectives (most plausibly their truth-conditions) that could interact in the appropriate way with a general projection mechanism. We will argue below that the later route is indeed viable, thus reconciling the need for differentiation with the appeal of a general and explanatory account of projection in general à la Schlenker. But with regards to existing theories of projection, the issue extends to theories such as that in Schlenker (2009), which posits symmetric and asymmetric filtering mechanism to be available across the board. If there are two filtering mechanisms and they are both equally available, then we expect to see no difference between conjunction and disjunction. 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 reaction might be to still postulate two filtering mechanisms, but tie their availability to the individual connectives, but that amounts to lexical specification of projection properties, with the corresponding loss of explanatory power. The other option is to postulate a new kind of projection mechanism that is uniform across connectives, but which derives

their distinct projection properties from the way this mechanism interacts 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.

4.2 Dynamic Semantics

Dynamic semantics (Heim (1983) a.o.) owes the central role it has played in presupposition theory to its powerful range of options for specifying context change potentials 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 (first pointed to by Rooth and Soames in its first decade of existence, and brought to more recent prominence by Schlenker's work). And yet, despite being such a powerful mechanism, coming up with a proper dynamic treatment corresponding to Option 1 in the previous section (i.e., implementing symmetric filtering for disjunction) 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 . For instance, here is the dynamic meaning for the sentence 'It is raining':

$$(40) \quad \llbracket \textit{It is raining} \rrbracket = \text{that function } f \text{ that takes a set of worlds } C \text{ and returns } C \cap \{w \mid \text{it is raining in } w \}$$

Sentences then denote the potential for changing any given context, and their meanings thus are aptly seen as 'context change potentials' (CCP). If a sentence S comes with a presupposition, this is modelled by treating the CCP of S as a partial function that is defined only on sets of worlds that satisfy the presupposition, i.e. only consist of worlds where the presupposition holds.

Following standard practice, we use the notation $C[\alpha]$ to express the application of the CCP denoted by α to the context C . To give a compositional semantics based on CCPs one needs to specify: 1) how to re-write the CCPs of complex sentences (like conjunction and disjunction) in terms the CCPs of their parts; 2) how to calculate the definedness of complex CCPs from the definedness of their parts. Here's how these two conditions are typically specified for conjunction:

$$(41) \quad C[\alpha \textit{ and } \beta] = (C[\alpha])[\beta]$$

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 $\llbracket \alpha \rrbracket$ to C). This has the effect of ridding C of any worlds where either (the underlying propositions of) α and β are false, which captures the classical

truth-conditional meaning of conjunction.

What about the definedness conditions of $C[\alpha \text{ and } \beta]$? Classical 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 $C[\alpha \text{ and } \beta]$ is defined iff $(C[\alpha])[\beta]$ is defined; this is defined iff applying $\llbracket \alpha \rrbracket$ to C is defined, and applying $\llbracket \beta \rrbracket$ to $C[\alpha]$ is defined. This means that 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. These represent asymmetric filtering conditions for conjunction, as β is interpreted relative to a context resulting from applying $\llbracket \alpha \rrbracket$ to the original context C .

The explanatory challenge for dynamic semantics is that there are many different 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)). For example, we could just as well specify the following rule for conjunction:

$$(42) \quad C[\alpha \text{ and } \beta] = (C[\beta])[\alpha]$$

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 a reverse conjunction with respect to filtering, yielding a right-to-left asymmetry - which does not seem to be attested anywhere in natural languages.

Can we specify a symmetric filtering version of disjunction, in line with Option 1 in the previous section, in dynamic semantics given the freedom it allows? 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:

$$(43) \quad C[\alpha \text{ or } \beta] = C[\neg\beta][\alpha] \cup C[\neg\alpha][\beta]$$

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.¹⁹ But then a disjunction will always be undefined if any 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.

¹⁹ $C[\neg\alpha]$ is re-written as $C - C[\alpha]$.

To get symmetric disjunction one needs to postulate access to two distinct CCPs to encode Left-to-Right and Right-to-Left filtering respectively:²⁰

- (44) a. $C[\alpha \text{ or } \beta] = C[\alpha] \cup C[\neg\alpha][\beta]$
- (defined iff all worlds in C satisfy the presupposition of α and all worlds where α is False satisfy the presuppositions of β)
- b. $C[\alpha \text{ or } \beta] = C[\beta] \cup C[\neg\beta][\alpha]$
- (defined iff all worlds in C satisfy the presupposition of β and all worlds 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 (41) and (42) for conjunction, thus predicting the in-principle availability of symmetry for conjunction as well (much like Schlenker’s two mechanisms proposal). One can again try to introduce a source for asymmetry to try to fix, e.g., by adding an order-constraint on possible re-write rules to the effect that either exclusively or preferably makes (41) and (44-a) available for conjunction and disjunction (see Rothschild (2011) for details). However, this again produces asymmetry uniformly across connectives, thus failing to capture the difference in projection properties between conjunction and disjunction, contrary to what our experimental results show.

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 fact, the only direct option for symmetric disjunction in just one lexical entry corresponds to 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.

4.3 Trivalent Semantics

Trivalent theories assume the existence of 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:

²⁰One 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.

(45)

$p \backslash q$	T	F	$\#$
T	T	F	$\#$
F	F	F	F
$\#$	$\#$	$\#$	$\#$

(46)

$p \backslash q$	T	F	$\#$
T	T	T	T
F	T	F	$\#$
$\#$	T	$\#$	$\#$

Table 2: Asymmetric trivalent conjunction Table 3: 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 means that a presupposition in the first conjunct always projects, 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' fails, 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.²¹ 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 (2008) remarkably shows, these tables can be derived via one general algorithm, stated below as Algorithm 1, shown below (we are simplifying here; see George (2008) 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. Thus, we derive the trivalent truth tables above.

²¹Note 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 (44-a) and (44-b) 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** the truth value of β is enough to make the sentence True on the classical
truth value, **then**
| assign True to the sentence on the trivalent table;
else
| assign # to the whole sentence;
end
end

Algorithm 1: The algorithm of George (2008)

While this should certainly be counted as a clear success, more would need to be said about the status and motivation of the algorithm above. Furthermore, we may want to ask whether a parallel result can be reached without invoking a trivalent semantics. We therefore turn to a new proposal, inspired by the approach in Schlenker (2009), but rethinking it to account for the differences in projection properties between conjunction and disjunction.

4.4 Limited Symmetry

Is it possible to develop a pragmatic account of projection, in the spirit of Schlenker (2009), but where the symmetry of disjunction and the asymmetry of conjunction fall out of a single mechanism? We argue that the theory recently advanced in Kalomoiros (2021, Forthcoming), dubbed ‘Limited Symmetry’, indeed promises to deliver in this regard. The following provides a crucial sketch of its features, with a focus on its relation to the present experimental findings.

We adopt the following basic propositional language \mathcal{L} , in an approach that is overall similar to that by Schlenker (2009):

$$(47) \quad \phi := p_i \mid p'_j p_k \mid (\text{not } \phi) \mid (\phi \text{ and } \phi) \mid (\phi \text{ or } \phi) \mid (\text{if } \phi. \phi) \\ (i, j, k \in \mathbb{N}; \text{ indices omitted below})$$

In $p'_j p_k$, p'_j encodes the presupposed content and p_k the entailments of the sentence that are not presupposed. Below, we will omit subscripts and will be using lower case letters to name propositions (p, q, r etc.), adopting the convention that the initial letter marked with a prime corresponds to the presuppositional information. We assume that the non-presupposed information is logically independent from the presupposition: $p \not\models p'$ and $p' \not\models p$.²² The semantics for this language is bivalent and classical. $p'p$ is

²²The idea to represent the presupposed content explicitly as separate is directly adopted from Schlenker (2009). The assumption that presuppositions are separable from the other entailments of a sentence is implicit in a lot of work on presupposition (and leads naturally to the assumption that

interpreted as conjunction: $w \models p'p$ iff $w \in F(p')$ and $w \in F(p)$, where F is a function assigning to each atomic formula a set of worlds.

The core idea, just like in Schlenker (2009), is to formalize how sentences are parsed from left to right, while assuming that contexts are updated incrementally where possible, and contextual constraints are evaluated relative to these locally updated contexts. But the specific implementation of this crucially differs from Schlenker's system in a way that brings about the desired differences, based on the interaction between the general update algorithm, the constraints imposed by presuppositions and the truth conditions of the connective at hand. The key ingredients of the formal implementation are the following:

i) Sentences are parsed from left to right, symbol by symbol, against a context C . At each parsing step, the parser gets access to the next *atomic unit* of the sentence. For \mathcal{L} our *atomic units* will be parentheses, atomic formulas (including ones with and without presuppositions, e.g., $p'p$ and p), and connectives. A parsing step t_i of a sentence S will consist of the i th atomic unit in the parsing list of S with everything that precedes it in the parsing list concatenated to its left. For example:

- (48) a. parsing list for $(p'p \text{ and } q)$:
 $[(, (p'p, (p'p \text{ and}, (p'p \text{ and } q, (p'p \text{ and } q)]$
 b. $t_3^S = (p \text{ and}.$

Crucially this gives us access to non-constituent elements like $(p'p \text{ and}.$

(ii) At every parsing point t_i , the parser computes two subsets of worlds in the relevant context: the set \mathbb{T} where, for every possible continuation d , the sentence is True, and the set \mathbb{F} where, for every possible continuation d , the sentence is False:

- (49) For any sentence S and parsing step t_i considered in Context C_i :
 a. $\mathbb{T}_{S_{t_i}} = \{w \in C_i \mid \text{for any good final } d, w \models t_i^S d\}$
 b. $\mathbb{F}_{S_{t_i}} = \{w \in C_i \mid \text{for any good final } d, w \not\models t_i^S d\}.$

(iii) The context for subsequent parsing steps is the context of the previous parsing step updated by removing all the worlds in \mathbb{F} as computed for that step:

(50) $C_{i+1} = C_i - \mathbb{F}_i$

(iv) We assume that for every \mathcal{L} -sentence S we have access to a [-presup] version S^- , where all the primed bits have been removed; e.g. $(p'p)^- = p$.

(v) Presuppositions introduce a constraint capturing the standard notion that

p and p' are independent). 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 idealisation, 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 idealisation, hence we adopt it here.

they should not introduce any new information of their own. In our system, we formulate this as a requirement that at any given parsing step, no worlds should be included in either \mathbb{T} or \mathbb{F} solely on grounds of presuppositional content. More formally:

- (51) For every sentence S and every parsing point t_i , it must hold that:
- a. $\mathbb{T}_{t_i^S} \subseteq \mathbb{T}_{t_i^{S^-}}$, and
 - b. $\mathbb{F}_{t_i^S} \subseteq \mathbb{F}_{t_i^{S^-}}$

Failing to meet this constraint will lead to presupposition failure. The subethood condition imposed here reflects that no primed parts of S , such as p' , can have decisive impact on inclusion of a given world in either \mathbb{T} or \mathbb{F} . After this constraint has been checked, the parser proceeds to parsing step t_{i+1} and repeats the above process relative to the context updated as per step (iii).

Let us now turn to how this system differentiates disjunction from conjunction with regards to the role of linear order for presupposition filtering: In a conjunction S of the form $(p'p \text{ and } q)$, at parsing step t_3^S , $(p'p \text{ and}$, the following will obtain:

- (52) a. For $t_3^S = p'p \text{ and}$:
- (i) $\mathbb{T}_{t_3^S} = \emptyset$
 - (ii) $\mathbb{F}_{t_3^S} = \{w \in C_3 \mid p'(w) = 0 \vee p(w) = 0\}$
- b. For $t_3^{S^-} = p \text{ and}$:
- (i) $\mathbb{T}_{t_3^{S^-}} = \emptyset$
 - (ii) $\mathbb{F}_{t_3^{S^-}} = \{w \in C_3 \mid p(w) = 0\}$
- c. Checking the presupposition constraint:
- (i) $\mathbb{T}_{t_3^S} \subseteq \mathbb{T}_{t_3^{S^-}}$
 - (ii) $\mathbb{F}_{t_3^S} \stackrel{?}{\subseteq} \mathbb{F}_{t_3^{S^-}}$

The \mathbb{T} sets are trivial in this case, as there is no world where it is guaranteed that no matter what second conjunct completes t_3^S , the whole sentence will be true (for any given world, many possible second conjuncts will be false). Accordingly, the subethood constraint is also trivially met with regard to these \mathbb{T} sets. The crucial issue is (c-ii), where the presuppositional subethood constraint does not generally hold, as there can be worlds that are included in $\mathbb{F}_{t_3^S}$ solely due to p' being false in them, whereas p is true, so that these will not be in $\mathbb{F}_{t_3^{S^-}}$. The only way to ensure that the constraint is met, then, is if the initial context C in which S is interpreted already is such that p' is true in all of them - in other words, that the presupposition is supported by the context. This corresponds to the standard result that presuppositions project from an initial conjunct.

In the context relative to which the second conjunct is evaluated, however, any worlds where the first conjunct is false will already have been removed (as per step (iii)

above), thus guaranteeing that no constraint on the initial context C results precisely if the first conjunct interpreted in C entails the presupposition of the second conjunct. Hence, we derive asymmetric filtering for conjunction.

Consider now what happens in a disjunctions S of the form $(p'p \text{ or } q)$: at parsing step t_3^S ($p'p \text{ or}$, we get:

- (53) a. For $t_3^S = p'p \text{ or}$:
- (i) $\mathbb{T}_{t_3^S} = \{w \in C_3 \mid p'(w) = 1 \ \& \ p(w) = 1\}$
 - (ii) $\mathbb{F}_{t_3^S} = \emptyset$
- b. For $t_3^{S^-} = p \text{ or}$:
- (i) $\mathbb{T}_{t_3^{S^-}} = \{w \in C_3 \mid p(w) = 1\}$
 - (ii) $\mathbb{F}_{t_3^{S^-}} = \emptyset$
- c. Checking the presupposition constraint:
- (i) $\mathbb{T}_{t_3^S} \subseteq \mathbb{T}_{t_3^{S^-}}$
 - (ii) $\mathbb{F}_{t_3^S} \subseteq \mathbb{F}_{t_3^{S^-}}$

In this case, the \mathbb{F} sets are trivial, because there is no world where it is guaranteed that no matter what second disjunct completes t_3^S , the whole sentence will be false (for any given world, many possible second disjuncts will be true). Thus the subsethood constraint on the \mathbb{F} sets also holds trivially. What about the \mathbb{T} sets? In this case, as shown in (c-i), the subset relation holds, as any world where both p' and p are true are also worlds where p is true. Thus, regardless of how the context relates to p' , the presuppositional constraint is met, and we can continue to the next relevant parsing step. In light of $\mathbb{F}_{t_3^{S^-}}$ being empty, $C_4=C_3$, and we get:

- (54) a. For $t_4^S = p'p \text{ or } q$:
- (i) $\mathbb{T}_{t_4^S} = \{w \in C_4 \mid (p'(w) = 1 \ \& \ p(w) = 1) \vee q(w) = 1\}$
 - (ii) $\mathbb{F}_{t_4^S} = \{w \in C_4 \mid (p'(w) = 0 \ \vee \ p(w) = 0) \ \& \ q(w) = 0\}$
- b. For $t_4^{S^-} = p \text{ or } q$:
- (i) $\mathbb{T}_{t_4^{S^-}} = \{w \in C_4 \mid p(w) = 1 \ \vee \ q(w) = 1\}$
 - (ii) $\mathbb{F}_{t_4^{S^-}} = \{w \in C_4 \mid p(w) = 0 \ \& \ q(w) = 0\}$
- c. Checking the presupposition constraint:
- (i) $\mathbb{T}_{t_4^S} \subseteq \mathbb{T}_{t_4^{S^-}}$
 - (ii) $\mathbb{F}_{t_4^S} \stackrel{?}{\subseteq} \mathbb{F}_{t_4^{S^-}}$

The subset relation between the \mathbb{T} sets straightforwardly holds: worlds where either both p' and p OR q are true are clearly also worlds where either p or q holds. The situation is more complex with the \mathbb{F} sets, effectively paralleling the case of second

conjuncts: in the general case, there can be worlds in C_4 where p' is false, p is true, and q is false. Such worlds will be in $\mathbb{F}_{t_4^S}$, but not in $\mathbb{F}_{t_4^{S-}}$ (since p is true and both p and q have to be false for a world to make it into the latter set). This reflects the possibility that the presupposition indeed can lead to infelicity if the other disjunct is unrelated to it and the context does not support it. But there are two situations where the subset constraint is guaranteed to be met, namely if (i) the original C already entails p' , as in that case, the type of world just considered won't be under consideration in C_4 to begin with. Alternatively, (ii), if the negation of q entails p' , then $\mathbb{F}_{t_4^S}$ cannot contain any worlds of this sort (as then there is no world where q and p' are both false, since we just posited that it follows from q being false that p' is true).²³ Thus, we get precisely the desired pattern, where the presupposition of the first disjunct can be filtered by the second disjunct, if the negation of the latter entails the former. Moreover, the way this filtering comes about is in no way related to linear order, since it doesn't come into play until the entire disjunction is considered. Therefore, exactly the same reasoning applies if the presupposition occurs in the second disjunct. Hence, we derive symmetric filtering for disjunction.

The discussion here of course only focused on conjunction and disjunction, whose differences in projection behavior were of central concern to the present paper. Much more needs to be said about other environments and predictions of this system, but we will leave that for another occasion. In closing, we simply observe that this approach has the promise of providing a pragmatically grounded, uniform and explanatory approach to projection based in a classical, bivalent semantics, much in the general spirit of Schlenker (2009): the driving force is that of incremental interpretation as a complex sentence unfolds; nonetheless the system makes it possible to derive the differences in the impact of linear order on projection across connectives that are empirically warranted by our experimental results. This is achieved by setting up the mechanism behind projection in such a way that lets it interact with the truth-conditional properties of connectives: in a nutshell, the presuppositional constraint as we formulated it has no bite until the full sentence is parsed for disjunction; this lets the disjuncts interact with regard to presuppositions in both directions. However, for conjunction, the presupposition constraint already bears on the felicity of the entire sentence by the time the first conjunct is evaluated. To the extent that the system succeeds beyond conjunction and disjunction (which we have reason to believe it does; Kalomoiros Forthcoming), this approach seems to be the one that is most successful empirically while maintaining the explanatory adequacy of the account by Schlenker (2009).

5 Conclusion

In this paper we have been concerned with the effect of linear order on presupposition projection in conjunction and disjunction. In two experimental studies, we find

²³The case where $p \models p'$ is excluded by assumption, since we have assumed that $p \not\models p'$.

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. These findings have important theoretical implications, in that they place a constraint on viable theories of projection. In particular, they argue against theories that take linear order as the sole arbiter of projection and filtering (cf. Schlenker (2009), Hirsch & Hackl (2014)), in a way that has uniform effects across connectives. Furthermore, theories like dynamic semantics, despite being powerful in allowing a lot (and perhaps 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 CCPs winds up running into a variant of the explanatory challenge, as parallel CCP-variants can't be ruled out for conjunction on general grounds). Trivalent accounts like that by George (2008) do better on this front, but require commitment to a departure from classical semantics, and may fall somewhat short on the explanatory front as well. However, the new 'Limited Symmetry' account first proposed in Kalomoiros (2021, Forthcoming), 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, thereby allowing for the types of differences in the effect of linear order on projection that we find in our experimental data. This therefore opens up a fruitful new avenue for modeling projection, with many new questions and predictions to be explored in future work.

6 Appendix

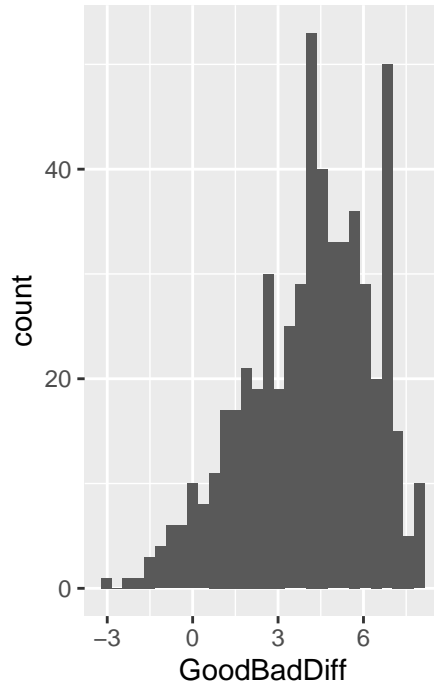


Figure 5: Histogram of participants' mean differences between good and bad fillers overall.

Looking at the relationship between differences between good and bad fillers and differences between PS-SECOND and PS-FIRST across conjunctions and disjunctions in Figure 7 (represented in the left two panels) with a simple linear regression model, we find a marginally significant interaction between coordination type and GoodBadDiff ($\beta = .20$, $SE = .122$, $p < .10$): while the difference increases (with relatively lower ratings for PS-FIRST) along with greater sensitivity for the contrast between good and bad fillers (GoodBadDiff) in the conjunction conditions, it actually gets smaller in the disjunction conditions. This provides an additional indication that presupposition-based order effects in disjunction and conjunction are different, with the latter aligning with the independent perspective on felicity-based acceptability from the fillers.

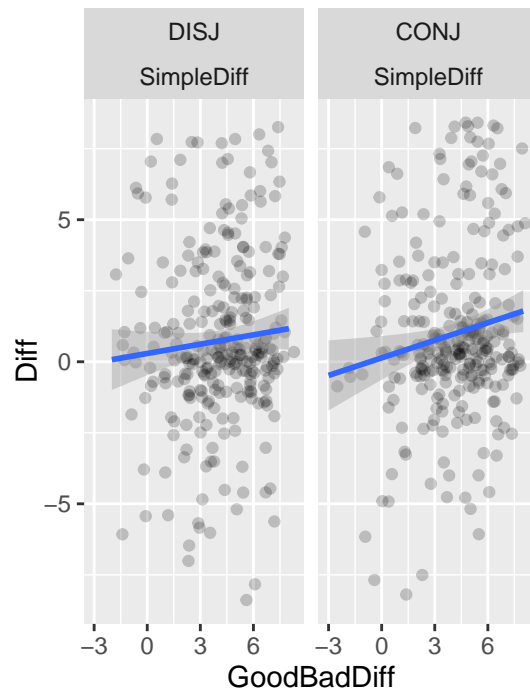


Figure 6: Correlation of differences between good and bad fillers and differences between Support and Explicit Ignorance contexts for SimplePs control condition

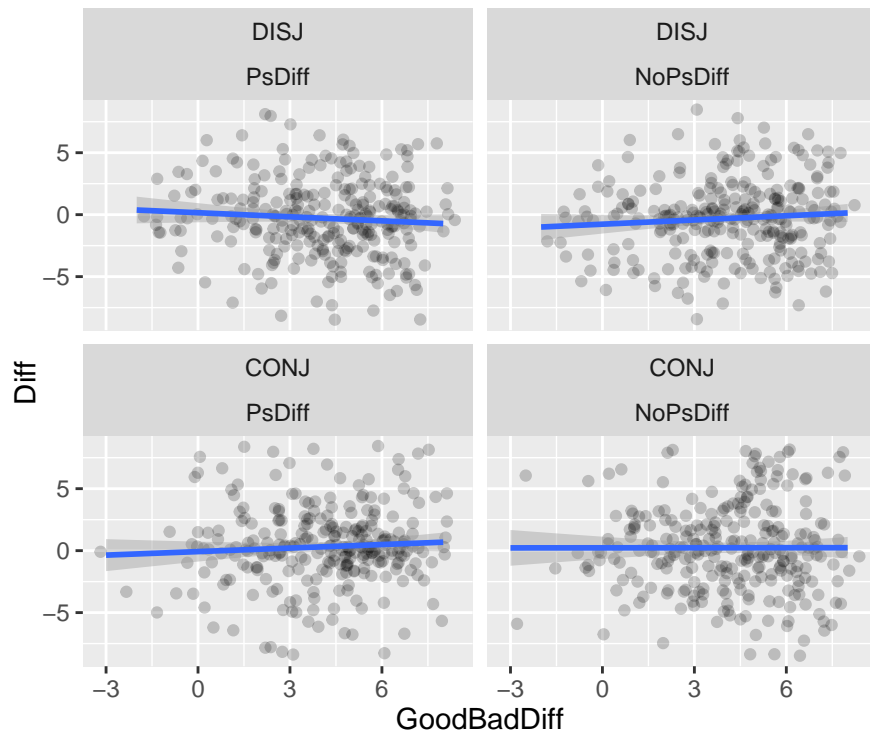


Figure 7: Correlations of critical and control coordination condition differences and good and bad filler differences

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