Presuppositions project asymmetrically, *unless* they don't

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Abstract

We present two experiments that shed new light on the old (but ongoing) debate on filtering (a-)symmetries with presuppositions (Karttunen 1974; Heim 1983; Soames 1989; Schlenker 2008 a.o.). The experiments establish that *unless* and *if not* exhibit symmetric filtering. In this respect, they pattern together with *disjunction*, and contrast with *conjunction*. We end by examining the ramifications of our results for possible theories of presupposition.

1 Introduction

A core choice point for suggested solutions to the projection problem is whether linear order should play a role in filtering calculations. The main relevant puzzle can be illustrated by comparing conjunction and disjunction:

(1)   Conjunction

 a. #John ate carbs again today and he ate carbs yesterday.
 b.   ✓John ate carbs yesterday and he ate carbs again today.

(2)   Disjunction

 a.   (#) Either John ate carbs again today or he didn't eat carbs yesterday.
 b.   ✓Either John didn't eat carbs yesterday or he ate carbs again today.

In conjunction we observe an asymmetry: while it is always possible to filter a presupposition in the right conjunct if the left conjunct entails it ((1b); *Left-to-Right filtering*), the reverse ((1a); *Right-to-Left filtering*) is not possible (Karttunen 1973; Stalnaker 1974).

Whether disjunction shows the same asymmetry has been much more controversial; while there has been an intuition that disjunctions show symmetric behavior in allowing both L-R and R-L filtering (e.g. Evans 1977's 'bathroom' sentences; Karttunen 1973, (ft. 11), Karttunen 1974, (ft. 3), Hausser 1976; Schlenker 2008 a.o.), it has also been argued that this intuition is linked to processes other than filtering (e.g., local accommodation/cancellation; Gazdar 1979 a.o.).[1]

In view of this landscape, two types of theoretical approaches have been developed. The first, dating in conception to the dynamic systems of Karttunen 1974 and Heim 1983, essentially lexicalized filtering: one could write down rules that allow only L-R filtering, or only R-L filtering, or both. Such systems can easily predict differences in (a-)symmetry between operators by individually specifying the availability of R-L and L-R filtering; but this comes at the cost of

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[1]Similarly, there have been attempts to blame the asymmetry of conjunction on processes beyond filtering, e.g. redundancy considerations (cf. Rothschild 2011 a.o.). However, the results of Mandelkern, Zehr, et al. 2020 speak against this, as redundancy was explicitly controlled for in their design.

stipulation and corresponding loss of explanatoriness (Rooth in a letter to Heim, Soames 1989; Heim 1990; Schlenker 2008).

The desire for more explanatory theories led to the second kind of approach, which starts from the assumption that all operators fundamentally allow both L-R and R-L filtering (i.e. they are fully symmetric in this respect). However, a general preference for L-R filtering is also posited, assumed to be rooted in general cognitive mechanisms behind incremental processing (following an intuition going back to Stalnaker 1974). Essentially, because humans have to process language incrementally, their filtering mechanism reflects this incrementality in the form of an L-R preference. A final assumption in this kind of theory (which we can call the *processing approach*) is that the default processing preference for L-R filtering can be overridden, but at a processing cost (Schlenker 2008; Schlenker 2009; Rothschild 2011).

While more explanatory, this processing approach faces at least two potential challenges. ***Challenge 1*** concerns the prediction that R-L filtering is uniformly costly across all operators, relative to L-R filtering. Finding genuine instances of R-L filtering that do not exhibit such relative costs would then present a challenge. And indeed, recent experimental evidence suggests that disjunctions like (2a) constitute such cases (Kalomoiros and Schwarz 2024).

Challenge 2 revolves around the issue whether it is indeed **linear** order that is relevant for the filtering system. The challenge comes from data involving conditionals:

(3) a. If John is happy that he is in France, then he isn't in Paris.
     b. John isn't in Paris, if he's happy that he's in France.

The intuition reported in the literature (Mandelkern and Romoli 2017; Mandelkern and Romoli 2018) is that both of these conditionals presuppose *John is in France*. But processing theories predict that in (3b) we should observe L-R filtering, since the antecedent is ***linearly preceded*** by material that should filter its presupposition that *John is in France* (i.e., the negation of the consequent *John is not in Paris*). So, to the extent that the whole conditional presupposes that *John is in France*, we might conclude that the notion of *linear precedence* doesn't make the right cut.[2] Under a more abstract structure-based notion of precedence, antecedents can be seen as always preceding consequents (regardless of linear order), and hence their presupposition is predicted to project in both (3a) and (3b) (Mandelkern and Romoli 2018).

Against this backdrop, we present two experiments that establish the following empirical points: **1)** *unless* and *if not* allow equally for both L-R and R-L filtering. This strengthens *Challenge 1* above for processing approaches. **2)** In our data, we have genuine instances of a presupposition in an antecedent being filtered by material in the linearly preceding consequent. This adds new nuance to *Challenge 2* by establishing that it is not a general feature of conditionals that presuppositions from their antecedents always project. We end by discussing the consequences of these findings for theories of presupposition.

2   The Experiments

We conducted two experiments, testing the filtering behavior of *unless* (Exp 1) and *if not* (Exp 2). We consider these near equivalents for present purposes. They were chosen due to a long-standing intuition that they are like disjunction in terms of filtering (Soames 1989; Schlenker 2009).

Our experiments follow closely a design established in two previous studies: Mandelkern, Zehr, et al. 2020, which tested the filtering behavior of conjunction, arguing that it is asymmetric; and Kalomoiros and Schwarz 2024, which applied the logic of Mandelkern, Zehr, et al. 2020 to disjunction, arguing for its symmetry.

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[2]Another route is to try to derive this pattern by considering more complex semantics for conditionals (e.g. strict and variably strict semantics). See Mandelkern and Romoli 2017 for this approach and challenges it faces.

2.1   Design

The stimuli were built around 3 triggers (*too, again, re-*). First, we had presuppositional sentences (Ps) that implemented an ORDER manipulation across the two connectives. These were presented in E(xplicit) I(gnorance) contexts that denied knowledge of the relevant presupposition (cf. Simons 2001; Abusch 2010):[3,4]

(4)   a.   EI CONTEXT: John and Mary are siblings and want to study abroad. Options include Tokyo and Kyoto in Japan, or Beijing and Shanghai in China. Mary is interested in studying in Japan: she would go to Kyoto on her own, but she doesn't want to go to an enormous city like Tokyo, unless John also comes with her to Japan (if not to Tokyo, then at least to Kyoto). I don't know what they ended up deciding so ***I have no idea whether Mary is currently studying in Tokyo or whether she even decided to go to Japan.*** However, given the above, I know that:
    b.   **Unless** John is studying in Japan too, Mary is not studying in Tokyo.   UN-PSFIRST
    c.   Mary is not studying in Tokyo, **unless** John is studying in Japan too.   UN-PSSECOND
    d.   **If** John is**n't** studying in Japan too, Mary is not studying in Tokyo.   IF-PSFIRST
    e.   Mary is not studying in Tokyo, **if** John is**n't** studying in Japan too.   IF-PSSECOND

Non-presuppositional (NoPs) variants that simply removed the relevant trigger were included to control for any order effects that are not due to the presence of a presupposition. For consistency, these were also presented in EI contexts (omitted here for space).

(5)   a.   Unless/If John is(n't) studying in Japan, Mary is not studying in Tokyo. NoPsFirst
    b.   Mary is not studying in Tokyo, unless/if John is(n't) studying in Japan. NoPsSecond

Finally, we included controls measuring the cost of local accommodation in (6), by contrasting, across EI vs. S(upport) contexts, presuppositional sentences whose consequent is unrelated to the presupposition and thus don't allow for filtering. EI contexts deny knowledge of the presupposition at the global level; thus, the only way to avoid a clash with the context is through local accommodation. In contrast, S contexts do not give rise to a contextual clash to begin with. Given that local accommodation is a costly operation (cf. Chemla and Bott 2013), the decrease in acceptability of such NOFILTERING sentences in EI contexts, compared to S contexts, provides a baseline measure for the cost of local accommodation across our triggers.

(6)   NOFILT
    a.   EI CONTEXT: . . .***I have no idea whether Mary is studying in Japan***. . .
    b.   S CONTEXT: . . .***I know that in the end Mary went to Japan, but I have no idea what John did***. . .
    c.   Unless/If John is(n't) studying in Japan too, Mary is unhappy.   NOFILTFIRST
    d.   Mary is unhappy, unless/if John is(n't) studying in Japan too.   NOFILTSECOND

2.2   Predictions

Processing accounts predict that PSSECOND cases should be more acceptable than PSFIRST. The reason is that in the latter case, using the material in the consequent to filter the presupposition of the antecedent requires recourse to R-L filtering. No such recourse is required in the PSSECOND

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[3]For a full list of stimuli, see the OSF page for this paper. Click *here* for a link.

[4]Due to space limitations, we cannot explicitly contrast our studies to Chemla and Schlenker 2012, the only previous study on filtering with *unless*, but we briefly note two important differences: 1) Our order manipulation keeps the presupposition trigger in the antecedent. 2) The negation of our consequent always asymmetrically entails the presupposition in our antecedents, as a further safe-guard against potential explanations that invoke local accommodation to explain symmetric effects (see Hirsch and Hackl 2014).

case, since the relevant material precedes the antecedent. Since this preference for PsFirst over PsSecond is driven solely by the presupposition, the cost it imposes should be ***in addition to*** any potential order-based preferences measured in the NoPs controls. As such, any effects of the Order manipulation should be more pronounced in the Ps cases compared to the NoPs ones. In statistical terms, this means that processing accounts predict an interaction between presuppositionality (Ps: Ps vs. NoPs) and order (Order: First vs. Second).

At the same time, processing accounts predict that the cost imposed by R-L filtering should be less than that of local accommodation.[5] This means that any decrease in acceptability between PsFirst vs. PsSecond (which measures the cost of R-L filtering) should be less than the difference between EI-NoFiltFirst/Second vs. S-NoFiltFirst/Second (which measures the cost of local accommodation). To think about this statistically, we need to set up the following factors: Filt categorizes conditions on the basis of whether they involve filtering or local accommodation. Thus PsFirst and PsSecond are categorized as Filt, and EI-NoFiltFirst/Second and S-NoFiltFirst/Second as NoFilt. Another factor, PriorS categorizes conditions on the basis of whether they exhibit linearly preceding support: PsSecond and S-NoFiltFirst/Second are coded as PriorS(upport) since they exhibit such prior support (because they are in an S context, and because of the preceding consequent respectively); PsFirst and EI-NoFiltFirst/Second are categorized as NoPriorS. Given this, the prediction that R-L filtering is less costly than local accommodation means that the effect of PriorS should be stronger in the NoFilt cases compared to the Filt cases: in other words, a Filt × PriorS interaction is predicted.

On a lexical view, the predictions depend on how *unless/if* is stipulated to project the presuppositions of its arguments.[6] The standard view in prior literature (e.g. Heim 1983 a.o.) is that presuppositions always project from the antecedent, with no option of filtering based on material in the consequent. Alternatively, we could assume that the consequent can always be used to filter the presuppositions of the antecedent, to capture apparent symmetric effects. Either way, we wouldn't expect any difference between PsFirst vs. PsSecond (going beyond any order-based differences already present in the NoPs controls); hence there should be no Ps × Order interaction. A Filt × PriorS interaction is still expected. The reason is that going from PriorS to NoPriorS should have a larger effect in the NoFilt conditions, and no effect in the Filt conditions (which should be equal).

If we stipulate that for both *unless* and *if* only L-R filtering is available, and assume that the R-L option is never available, then we predict a Ps × Order interaction (for the same reason this prediction is made on processing accounts). We also predict no Filt × PriorS interaction: since no R-L filtering is available, the only way to save PsFirst from projection is to apply local accommodation. Hence the difference between PsFirst vs. PsSecond should parallel fully the difference between EI-NoFiltFirst/Second and S-NoFiltFirst/Second.

2.3 Procedure

24 critical items were created in total (8 per trigger). There were also 24 fillers. For each connective the stimuli were divided into two lists: the Ps list contained the PsFirst, PsSecond and EI-NoFiltFirst/Second conditions; the NoPs list contained the NoPsFirst, NoPsSecond and S-NoFiltFirst/Second conditions. Each list then formed its own sub-experiment, and was counterbalanced in a Latin Square design, with 6 items per trigger appearing in each condition. Once assigned to one of the Latin square groups in a given list, each participant saw 48 items

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[5]It's technically possible to state a processing account where R-L filtering is as costly as local accommodation. But such an account isn't effectively distinguishable from an account where there is no R-L filtering, but only local accommodation, at least on the acceptability measure we are using here.

[6]On all accounts negation projects its presuppositions. So projection for the antecedent of *if not* depends solely on the projection rule for *if*.

(24 critical and 24 filler) in random order. They were presented with a context and a sentence and were asked to judge how natural the sentence sounds in the given context on a 1-7 scale. For *unless* we collected responses from 106 people in the Ps list, and from 95 people in the NoPs list (participants were recruited from the UPenn subject pool). For *if not* we collected responses from 100 people in the Ps list, and from 99 people in the NoPs list (participants were recruited on Prolific).
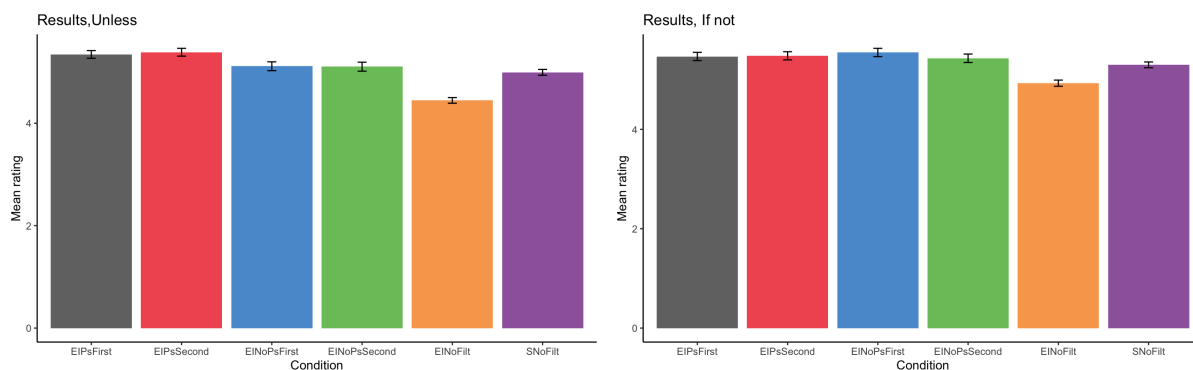
2.4   Results

Figure 1: Results. Mean rating by condition, for each connective. Error bars represent standard error. EI-NoFILT collapses the results for EI-NoFILTFIRST and EI-NoFILTSECOND. Similarly for S-NoFILT.

As is clear from Fig 1, *unless* and *if not* showed parallel behavior. Firstly, for both connectives ORDER has no effect on acceptability either in the Ps or the NoPs conditions, suggesting that there is no ORDER × Ps interaction. Indeed fitting a cumulative mixed-effects model predicting Rating from ORDER, Ps and their interaction (including random intercepts for participant and item), is consistent with this (UNLESS: $\beta = -0.02$, $SE = 0.15$, $z = -0.19$, $p = 0.8$, IF NOT: $\beta = -0.05$, $SE = 0.16$, $z = -0.3$, $p = 0.7$).[7]

Given that this is a null result, we used a Bayesian approach to quantify our credence in the model without the ORDER × Ps interaction. We conducted Bayesian analyses of the data for both connectives, using the data from Mandelkern, Zehr, et al. 2020 in order to extract priors.[8] We then proceeded to conduct a Bayes factor analysis. For both connectives, we found extremely strong evidence for the model without the interaction ($BF_{10} < 0.01$, Jeffreys 1939).

To evaluate the FILT × PRIORS interaction, we fit (for both connectives) a cumulative mixed-effects model predicting Rating from FILT, PRIORS and their interaction (including random intercepts for participant and item, as well as a by-participant random slope for FILT, and by-item random slopes for FILT and PRIORS). The interaction comes out significant for both connectives (UNLESS: $\beta = -0.53$, $SE = 0.17$, $z = -3.05$, $p = 0.002$, IF NOT: $\beta = -0.45$, $SE = 0.21$, $z = -2.07$, $p = 0.03$). This is driven by the fact that there is a difference between EI-NoFILT vs. S-NoFILT, but no difference between PsFIRST vs. PsSECOND.

3   General Discussion

The summary in Table 1 points to R-L filtering for *unless/If not* without any additional cost (relative to L-R filtering), parallel to disjunction (Kalomoiros and Schwarz 2024). Thus, this strengthens the evidence that a processing approach that postulates a uniform L-R bias across connectives is ultimately untenable.

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[7]In all the mixed-effects models reported in this paper, all factors were sum-coded.

[8]This was possible because our design is parallel to Mandelkern, Zehr, et al. 2020 design.

Prediction	Processing	Lexical (asym)	Lexical (sym)	Results
ORDER × Ps	✓	✓	✗	✗
FILT × PRIORS	✓	✗	✓	✓

Table 1: Predictions + Results.

Another important question was whether filtering presuppositions was allowed even in sentence-final antecedents in the L-R direction. Our results show that at least for negated antecedents, filtering based on preceding consequents is indeed possible.[9]

From the types of theories we have reviewed in this paper, only a lexical view where antecedents are assumed to always allow for both L-R and R-L filtering is consistent with our results. Of course, even if such an approach turns out to be descriptively adequate (more on this below), it still doesn't solve the explanatoriness problem that lexical approaches face. On the contrary, the fact that two essentially equivalent connectives (*unless* and *if not*) show the same filtering behavior raises the suspicion that filtering properties derive from truth conditions, and aren't just a matter of stipulation.

At this point, two other, more recent, approaches should be mentioned which are compatible with our data: the *'disappointment'* approach in George 2008, and the *Limited Symmetry* approach in Kalomoiros 2023. Both are designed to predictively derive asymmetric filtering for conjunction, and symmetric filtering for disjunction and (at least some) conditionals. George 2008 is a trivalent theory, while Kalomoiros 2023 takes the processing approach of Schlenker 2008 as its starting point, and modifies it to predict the relevant (a-)symmetries.

Can we further differentiate between these three approaches? Yes. Their predictions come apart when looking at **conditionals with positive antecedents**. The symmetric lexical approach and the trivalent *'disappointment'* approach predict that presuppositions in antecedents can always be filtered by the negation of the consequent, regardless of the polarity of the antecedent. This prediction is a general feature of the compositional way in which these approaches are stated: the presuppositions of an operator derive solely from the presuppositions of its arguments. Since presuppositions project from negation, a positive antecedent A and its negation $\neg A$ are always presuppositionally equivalent; hence, $A \to B$ and $\neg A \to B$ are predicted to have the same presuppositions.

However, the *Limited Symmetry* approach predicts that conditionals with negated antecedents (and hence also *unless*) should be symmetric, but once the negation is removed, asymmetric L-R filtering becomes the default (see Kalomoiros 2023).

Looking forward, our plan is to to test this fascinating split in predictions, hopefully shedding further light into the thorny issues of (a-)symmetries in conditional constructions.[10]

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[9]The triggers we tested did not include factives or change-of-state verbs, as in the examples discussed in Mandelkern and Romoli 2018, hence we cannot rule out at this stage that those type of triggers might behave differently in these environments.

[10]As a preview, initial results from deploying our experimental design on conditionals with positive antecedents point to an asymmetry, with R-L filtering being more costly than L-R.

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