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Experimentally assessing the symmetry of presupposition filtering across disjunction*

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1. Introduction

We present an experimental investigation of disjunction as a presupposition filter. We focus on sentences of the form $\lceil \text{not } p' \text{ or } q_p \rceil$ and $\lceil q_p \text{ or not } p' \rceil$, where q_p is a sentence that presupposes p and p' is a sentence that entails p . This is exemplified in (1), following examples from Barbara Partee, where q_p = 'the bathroom is upstairs' and p' = 'there is a bathroom'. Since in either order in (1) the sentence does not presuppose p , these examples have been taken as evidence for symmetric filtering across disjunction, contrasting other connectives like conjunction which are thought to be asymmetric.

- (1) a. Either there is no bathroom or the bathroom's upstairs.
- b. Either the bathroom's upstairs or there is no bathroom.

However, some have noted that the examples in (1) do not provide conclusive evidence in favor of a symmetric view of disjunction. An independently proposed mechanism of local accommodation can account for the lack of presupposition in (1b). Local accommodation allows presuppositions to not project when conflicting with other inferences. For disjunction, there is an expectation that the truth or falsity of each disjunct is unsettled. Presupposing that there is a bathroom in (1b) violates this expectation.

With local accommodation, we have three possible explanations (in 2) for the pattern in (1). Previous experimental work provides conflicting evidence for symmetric filtering (c.f. Hirsch & Hackl 2014 and Hirsch et al. 2018 for evidence against, Kalomoiros &

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Schwarz 2023 for evidence in favor). To differentiate the hypotheses in (2), we look at sentences where the filter p' *properly* entails the presupposed content, as in (3) below. In these examples, local accommodation is not expected: the presupposition that Mary lives in France is compatible with Mary not living in Paris. On H1 the presupposition should always be filtered; on H2 the presupposition should only be filtered in the canonical order (3a); and on H3 the presupposition should never be filtered.

- (2) H1. Filtering across disjunction is **symmetric**.
H2. Filtering across disjunction is **asymmetric**. Local accommodation applies in the non-canonical order (presupposition trigger first, filter second).
H3. Disjunction is not a filter. Local accommodation still applies.
- (3) a. Either Ellen doesn't live in Paris, or John knows she lives in France.
b. Either John knows Ellen lives in France, or she doesn't live in Paris.

In this paper we describe two experiments. The first is an inference task, leveraging items like those in (3), which provides initial evidence against an asymmetric view of disjunction. The second is a reasoning task, aimed at exploring a possible performance based factor explaining the general decrease in filtering for properly entailed items that we observed in the first experiment.

2. Presuppositions and filtering

2.1 Theoretical background

Presuppositions are often thought of as conditions on a discourse context that must be met to use a particular expression (in the tradition following Stalnaker 1974). Characteristically, presuppositions project: when embedded in non truth preserving contexts, as in (4b) and (4c), the presupposition is preserved.

- (4) a. John stopped smoking.
b. John didn't stop smoking.
c. If John stopped smoking, we should get him a cake.

Another property of presuppositions is filtering. As seen in (5), certain environments 'filter' presuppositions so that they disappear. To account for filtering, theories of presupposition projection often appeal to local contexts: subexpressions are evaluated relative to intermediate versions of the global context (Karttunen 1973). In a conditional (5a) the local context of the consequent is the global context updated with the information in the antecedent. If the antecedent entails the presuppositions of the consequent, those presuppositions will always be satisfied, and the entire expression will presuppose nothing.

- (5) a. If John used to smoke, then he stopped smoking.

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

For any operator, we can try to specify the local context for each of its arguments. This is implemented theoretically, for example, in the dynamic account of Heim (1983). More recent approaches to presuppositions take a more explanatory approach, searching for a general procedure for predicting the filtering behavior of a logical operator. Schlenker (2008, 2009) proposes that local contexts emerge out of an effort to restrict attention to a subset of the global context when truth-conditional equivalence is guaranteed. Schlenker proposes that this process might have both a left-to-right version and a costlier symmetric version that can account for the pattern with disjunction.

Positing a general symmetric operation for calculating local contexts, however, leaves unexplained why symmetric filtering seems generally *unavailable* for conjunction. While it has been suggested that the order contrasts observed with conjunction may be due to independent constraints on well-formedness and the ordering of information, Mandelkern et al. (2020) provide key experimental evidence reinforcing the view that conjunction is an asymmetric presupposition filter.

Instead, Hirsch & Hackl (2014) preserve an asymmetric theory of presupposition projection, arguing that the appearance of symmetry is due to an independent mechanism: local accommodation triggered by violation of a pragmatic constraint (Heim, 1983), in this case non-opinionatedness (cf. Schlenker 2008, Gazdar 1979). NO requires that the speaker be ignorant of the truth of each disjunct. When the filter is identical to the presupposition, this leads to a violation of NO whenever the presupposition is not filtered. In (1b) above, if the speaker presupposes that there is a bathroom, this conflicts with the second disjunct, that there is no bathroom.

(6) *Non-opinionatedness (NO)*

An expression of the form ' p or q ' can only be felicitously uttered when the speaker is not opinionated about the truth-value of either $\llbracket p \rrbracket$ or $\llbracket q \rrbracket$.

When the presupposition clashes with NO, the presupposition needs to be cancelled as a last resort. Local accommodation can be used to accomplish this. Local accommodation of a presupposition effectively renders it equivalent to an at-issue conjunct at the location where it was triggered. Hirsch & Hackl thus argue that, because we always have access to NO-triggered local accommodation, the appearance of filtering in these disjunctions does not rule out the possibility of an asymmetric, left-to-right theory of presupposition filtering.

Kalomoiros & Schwarz (2023)

Kalomoiros & Schwarz (2023), building on Mandelkern et al. (2020), present two experiments providing evidence for disjunction as a symmetric presupposition filter. The authors argue that, if the apparently symmetrical behavior of disjunction is explained via a costly extra operation (as in Schlenker 2008 or Hirsch and Hackl 2014), it should be possible to observe an asymmetry in acceptability judgments with disjunctions. K&S's Exp. 2 com-

pared the acceptability of conjunctions and disjunctions, embedded in the antecedent of a conditional, as in (7).

- (7) a. Disjunction: If Kat either has stopped doing spelunking or has never done any kind of spelunking, then this trip is not for her.
b. Conjunction: If Kat has stopped doing spelunking and has only done spelunking in easy caves, then this trip is not for her. [K&S 2023, p. 17]

Key to their methodology is the assumption that the acceptability of presuppositions in ignorance contexts can be used to get a signature for local accommodation, when compared to the same expressions in contexts that support the truth of the presupposition. For disjunctions, they argue that any asymmetry should be detectable as a similar decrease in acceptability in the non-canonical (right-to-left) filtering order. They observe a clear order-based asymmetry for conjunction. In contrast, no such asymmetry was found for disjunctions, with similar levels of acceptance across both conditions.

Our own experiment assesses similar data with a more direct measure. While acceptability judgments might be degraded for reasons independent of local accommodation (K&S's controls without presupposition triggers also had lower acceptability judgements), we present participants with an inference task, with key conditions avoiding local accommodation.

3. Experiment 1: (a)symmetric filtering

3.1 Design

Experiment 1 was an inference task investigating whether disjunction is a symmetric presupposition filter. Participants were presented with disjunctions with a presupposition trigger in one disjunct, and asked if the speaker believed the presupposition. We considered the three competing hypotheses in (2). Key to our design was the use of items in which a presupposition is *properly entailed* by its filter. Such examples allow filtering to be distinguished from local accommodation. In (8a), the presupposition and the filter mutually entail each other. In (8a) filtering and local accommodation are confounded — either could be the source of the lack of presupposition. In contrast, in properly entailed items (8b), the presupposition is entailed by its filter but not vice versa. Since presuppositions are filtered when entailed by their local context, the presupposition should be filtered in (8b). Local accommodation, however, is unexpected. On Hirsch & Hackl's view, local accommodation is triggered by violating non-opinionatedness: do not use a disjunction if the truth-value of either disjunct is known. In (8b), the presupposition that Ellen lives in France is compatible with the disjunct that *Ellen doesn't live in Paris*, so local accommodation is not triggered.

- (8) a. Either John knows Ellen lives in France, or she doesn't live in France.
b. Either John knows Ellen lives in France, or she doesn't live in Paris.

Experimentally assessing filtering in disjunctions

We capture these sentences schematically in (9), where p_+ signifies that p_+ entails p and p does not entail p_+ .

- (9) a. *Mutual entailment*: not p or q_p
b. *Proper entailment*: not p_+ or q_p

The experiment included four target and two baseline conditions, with 9 items in each condition. The target and baseline conditions were formed from two factors, **entailment-pattern** and **disjunct-order**, with three and two levels respectively. All target and baseline items were disjunctions with a presupposition trigger in one of the disjuncts. The factor **disjunct-order** tracked whether the presupposition trigger occurred in the **first** or **second** disjunct. The factor **entailment-pattern** changed the content in the non-presuppositional disjunct. The target conditions were formed, following the items in (8), from the levels **mutually-entailed** and **properly-entailed**. Our baseline conditions were formed from a third level for entailment-pattern, **non-entailed**. An example is shown in (10) below. In non-entailed items, there is no entailment between the presupposition and the opposing disjunct. There should thus be no filtering or local accommodation. These items provide us with a baseline level of acceptance of the presuppositions in disjunctions.

- (10) Either Susan's been keeping a low profile, or John knows she lives in France.

The 9 items included three different trigger types—factives, state related verbs, and definite descriptions—with three items for each trigger type. All participants saw all items in all conditions. The experiment also included 12 controls and 6 fillers. Controls were simple conditionals, with a presupposition trigger in the antecedent. Participants were expected to always accommodate the presupposition. These controls were used to exclude participants that failed to satisfactorily complete this task. Fillers were conditionals with no presupposition trigger. All items were presented as overheard conversations between two unknown speakers, as in (11).

- (11) *You overhear two speakers talking. One of them says:*
“Either Mary doesn't live in Paris, or John knows she lives in France.”
From this can you conclude that the speakers believe that Mary lives in France?

3.2 Participants & Procedure

50 native English speakers were recruited on Prolific. The experiment was built and hosted using PCIBex. Participants were presented with consent and instructions before being shown two practice items with feedback. They were then shown 72 experimental items, randomly shuffled. A sample version of the experiment is available at <https://farm.pcibex.net/r/mNAYOT/>. We excluded participants who failed to correctly answer more than 75% of the controls; 8 participants were excluded accordingly. The experiment was preregistered: <https://osf.io/kvezb>.

3.3 Analysis & Predictions

We laid out three theoretical possibilities in (2): (H1) disjunction is a symmetric filter, (H2) disjunction is asymmetric, (H3) disjunction is not a filter. The interaction of order and entailment can be used to assess these. We summarize the key predictions in (12) below. For all theories, we expect low acceptance of the presupposition in the mutually entailed conditions and high acceptance of the presupposition in the baseline conditions. For the properly entailed conditions, each theory makes different predictions. On H1, we expect low acceptance of the presupposition in both disjunct orders (due to filtering). On H2, we expect an interaction of order and entailment, with high presupposition acceptance rates when the trigger comes first, and low when the trigger comes second. On H3, acceptance rates should be high (matching baseline) in both disjunct orders.

(12) *Predictions for properly entailed items:*

H1. Low presupposition acceptance in both orders

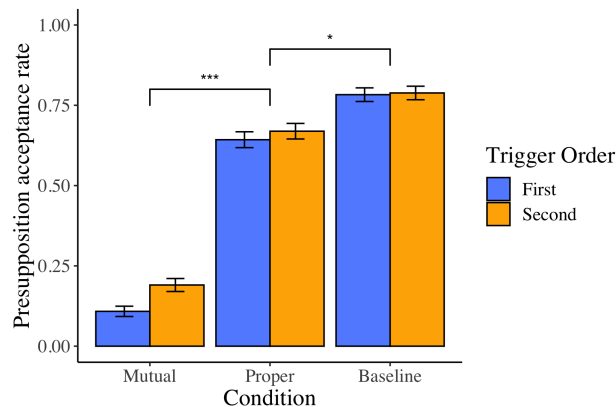
H2. Low acceptance when trigger second. High when trigger comes first.

H3. High acceptance in both orders.

3.4 Results

The overall rate of presupposition acceptance across conditions is shown in (13) below. We see the acceptance of the presupposition in the properly-entailed condition is much higher than in the mutually-entailed condition, and no clear effect of order.

(13) *Exp. 1 - Mean presupposition acceptance rates by condition*



As a planned first analytical step, we fit a logistic regression model to investigate the interaction between the factors of order and entailment, subsetting the data to only the mutually-entailed and properly-entailed conditions. The factors were each treatment coded (ENTAILMENT: proper = 0, mutual = 1; ORDER: first = 0, second = 1), and we included random intercepts for subject and item-type, and random slopes for entailment by subjects.

(14) ENTAIL \times ORDER mixed effects summary

	Coefficient	Std. Error	z value	Pr(> z)
entailment(1=mutual)	-3.4522	0.2896	-11.919	< 2e-16 ***
order(1=second)	0.1417	0.1685	0.841	0.40022
entailment(mut):order(2nd)	0.6827	0.2912	2.344	0.01905 *

The results are summarized in (14). We observe a significant effect for the interaction term. While the interaction could suggest support for asymmetric filtering, it appears the interaction is driven almost entirely by an effect of order in the mutually-entailed condition, with greater acceptance of the presupposition when the presupposition came second. This is unexpected on any theory. To conclude in favor of asymmetric filtering, we would have to interpret these patterns as involving some unknown factor X which uniformly favors a greater rate of acceptance when the presupposition comes second (maybe a recency effect), explaining what is observed in the mutually-entailed condition; the *absence* of a difference in favor of the presupposition-second order in the proper entailment condition could then be explained by an asymmetry in filtering whereby presuppositions are filtered out more easily when the presupposition comes second (as expected under H2), counterbalancing the effect of Factor X. Such an interpretation strikes us as speculative, and we conclude that our data do not provide strong evidence for H2.

We then turned to a model considering the main effect of entailment. We subsetted the data to the mutually-entailed and properly-entailed levels, fitting a logistic regression with random intercepts for subject and item and slopes for entailment by subject and by item. Comparing this to a null model with only the intercept using a likelihood ratio test (with the ANOVA call in R), we find a significant effect of the factor ENTAILMENT ($p < 0.001$), providing support for H3, no filtering.

Finally, we re-subsetted the data, comparing the properly-entailed conditions to the baseline. Visually, we see that responses to the properly-entailed condition are high but slightly below the baseline. Fitting a logistic regression, with the same random effects structure as before and comparing it to a null model using a likelihood ratio test, we find a significant effect of ENTAILMENT ($p = 0.0357$), supporting H1, symmetric filtering.

3.5 Discussion

The results above paint a mixed picture. The high levels of presupposition acceptance in the properly-entailed conditions suggest that disjunction might not work as a filter at all. However, the responses are not at baseline, suggesting a more complicated underlying picture. It is possible that some combination of H1 and H3 drives the results. Different participants might use different strategies. Alternatively, the same participant might demonstrate mixed behavior, occasionally employing filtering and occasionally not.

There is one possibility for a mixed theory that strikes us as most promising: H1 holds and disjunction is symmetric, but participants fail to filter for performance-based reasons. To filter, participants must notice that the negation of one disjunct entails the presuppositions of the other. If this is sometimes difficult, it may drive the lack of filtering we observe.

4. Experiment 2: Double negation and entailment

4.1 Design

In Experiment 2, we investigated a performance based explanation of the results from the first experiment: filtering fails because participants fail to identify the right logical relationship. To correctly filter through a disjunction, the listener must see that the negation of the other disjunct entails the presupposition.

In this experiment, we presented participants with a reasoning task, exemplified in (15), replicating our target condition. Participants were asked to answer the question in (c) with one of three options: ‘Yes’, ‘Maybe’, or ‘No’. Below, the correct answer is ‘Yes’; participants must realize that (a) being false means that (b) is true, replicating the logical steps involved in filtering a presupposition through a disjunction. This task was presented for each of the 9 items of the previous experiment. By-item scores were collected used by averaging over our participants’ responses, and then used to assess whether the responses in this task could predict the performance in Exp. 1.

- (15)
- a. John thinks Cameron doesn’t live in Paris.
 - b. Mary thinks Cameron lives in France.
 - c. John is wrong. Is Mary right?

In the target condition, (15), participants were told not- p_+ was wrong, and asked if p was right. We included 9 fillers and 18 distractors. The 9 fillers had the same form as above, replacing not- p_+ with p . Here the answer was also ‘Yes’. Half of the 18 distractors were like the fillers, but participants were told Speaker 1 was right, and asked if Speaker 2 was right. The answer was straightforwardly ‘No’. The other half exemplified different entailment patterns, set so that the correct answer was ‘Maybe’.

4.2 Participants & Procedure

60 native English speakers were recruited using Prolific. The experiment was built and hosted using PCIBex. Participants were presented with consent and instructions, before being shown three practice items with feedback. They were then shown 36 experimental items, randomly shuffled. The experiment is available online at <https://farm.pcibex.net/r/yeeEQo/>. 6 participants failing more than 75% of the p /not- p distractors were excluded.

4.3 Analysis & Predictions

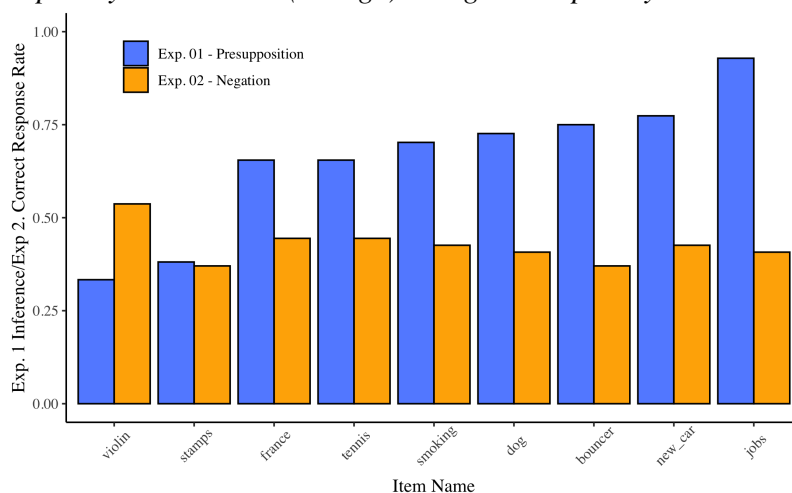
We planned to use the average performance on each target item as a predictor variable for the corresponding Exp. 1 response. On the performance-based revision to H1, We expect an inverse relationship: items with better performance in Exp. 2 (i.e. closer to 1) should have lower rates of presupposition acceptance in Exp. 1.

4.4 Results

Figure 16 presents the average performance for each item in the target condition (orange), next to the rate of presupposition acceptance for the corresponding item in Exp. 1 (blue).

To assess the relationship between these results, we fit a logistic regression model with the Exp. 1 response as the response variable, and the average responses by-item from Exp. 2 as a predictor. The model included random intercepts by Exp. 1 subject. We found a significant effect ($p < 0.001$) of the by-item Exp. 2 score.

(16) *Exp. 2 by-item results (orange) alongside Exp. 1 by-item results (blue)*



4.5 Discussion

The results in the preceding section suggest item-based variation in the acceptance of presuppositions in Exp. 1 can be explained by item-based variation in the ability to identify the relevant entailment relation for filtering. There are reasons to be cautious here, primarily the limited number of data points—the results are based on average responses for 9 items. One preferable alternative would be to have the tasks from Exp. 1 and 2 performed by the same participants so that an individual’s responses on Exp. 2 could be matched to their performance on Exp. 1. This would give us a stronger basis for evaluating the claim that difficulty identifying the entailment relations leads to a reduction of filtering.

There are reasons to think this understanding of the situation is moving in the right direction. Notable is the sharp contrast in performance between the target items in Exp. 2, with a proper entailment relation, and the filler items, with a mutual entailment relation. Participants performed well on fillers (83.3% correct), but poorly on target items, getting only 42.6% correct. If it is generally difficult to see that ‘not not $p+$ ’ entails p , this may explain why we see less filtering in general in the properly entailed items from Exp. 1.

5. Conclusion

In this study, we present additional evidence against an asymmetric view of disjunction for presupposition filtering. While not conclusive, the results further suggest that disjunction is

a symmetric filter for presupposition filtering. Exp. 1 presented participants with an inference task, where the key condition were disjunctions with a presupposition trigger in one disjunct and a filter that properly entailed the presupposition the other. There we found no effect of the order of the disjuncts, and in addition found unexpectedly high rates of acceptance of the presupposition, regardless of the order of the disjuncts. As an initial step to explore whether this was due to a lack of filtering in disjunction or a due to a performance related issue, we presented participants with a second experiment assessing whether the ability to identify the relevant entailments for filtering in a given item correlates with the inference of presuppositions for those items. We find that it does, and further that participants generally perform poorly when there is a proper entailment between the propositions in question. While there are sharp limitations in generalizing from the results of this experiment, it provides a promising path forward for assessing the presupposition filtering properties of disjunction.

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