Incremental presupposition evaluation in disjunction*

Aron Hirsch & Martin Hackl

Massachusetts Institute of Technology

1. The puzzle

This paper is concerned with the problem of presupposition projection in complex sentences: how are the presuppositions of the whole sentence related to the presuppositions of its component expressions? Our focus is on cases where the linear order of the component expressions affects projection.

One case where there are clear effects of linear order is conjunction. As Karttunen (1973) observed in his seminal work on projection, all presuppositions of the first conjunct are inherited by the entire conjunction (they "project"), while presuppositions of the second conjunct are "filtered" when they are entailed by the asserted content of the first conjunct. This is illustrated in (1).

(1) a. #The king of Tajikistan is bald, and Tajikistan has a king.
b. Tajikistan has a king, and the king of Tajikistan is bald.

The definite description *the king of Tajikistan* triggers the existence presupposition that Tajikistan has a king; the conjunct that does not contain the definite description entails (in fact, is equivalent to) the presupposition. There is a contrast between (1)a and (1)b. (1)a, where the definite description is in the first conjunct, is deviant, which is suggestive of projection: if (1)a presupposes that Tajikistan has a king, it is redundant to assert separately in the second conjunct that Tajikistan has a king, and the conjunction degrades due to this redundancy. (1)b, by contrast, is felicitous even in contexts where it is not established prior to utterance of the conjunction that Tajikistan has a king. The presupposition does not project in (1)b.

To account for asymmetries like that in (1), theories of presupposition projection have been proposed which include an incremental component to presupposition evaluation

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(e.g. Schlenker 2008, 2009, Fox 2008, cf. Chemla & Schlenker 2012). The idea is to link asymmetries in projection to the incremental left-to-right nature of sentence processing by assuming that presupposition evaluation also proceeds incrementally left-to-right.

However, if general processing considerations are at play, we would expect that asymmetries should be observed not only with conjunction, but across all sentential connectives. Disjunction is a well-known counter-example. It appears from classic examples in the literature, at least, that projection in disjunction is symmetric. (2), due to Barbara Partee (Partee 2005), is a case of this sort:

(2) a. Either the bathroom is in a funny place, or there is no bathroom.
b. Either there is no bathroom, or the bathroom is in a funny place.

The presupposition triggered by *the bathroom* does not project in either (2)a or (2)b; both are felicitous in contexts where it is not already established that there is a bathroom. It appears that a presupposition triggered in either disjunct is filtered when entailed by the negation of the asserted content of the other disjunct.

From the perspective of incremental theories of presupposition evaluation, the difference between conjunction and disjunction is puzzling: why is projection in conjunction sensitive to the linear order of the conjuncts, but projection in disjunction not sensitive to the linear order of the disjuncts? This paper offers a resolution to the puzzle while maintaining the central tenet of incremental presupposition evaluation. We point out a confound in (2), and argue that once the confound is taken into account, incremental theories no longer predict asymmetric projection in (2). They do, however, predict that (2)a and (2)b have different processing signatures, and we report two sets of experimental results consistent with this revised prediction.

2. A processing account of conjunction

This section makes explicit our version of the processing account of asymmetry in conjunction. We introduce the background assumptions we will make about pragmatic processing (section 2.1), and show that asymmetric projection is expected under these assumptions (section 2.2).

2.1 Processing assumptions

Presuppositions are evaluated relative to a *local context*. We adopt Schlenker's (2009) theory of local contexts by which local contexts are derived in a predictable way from the *global* context.[1] In the Stalnakarian (e.g. 1978) view, the global context can be modeled as the set of worlds compatible with everything the conversational participants mutually agree is true in the actual world. This is called the *context set*, C. As each new sentence S is uttered in a discourse and accepted by the interlocutor, C shrinks. Those worlds in which the proposition S expresses (φ_S) is true are kept in C, while those worlds in which φ_S is false are eliminated. The comprehender's task when a speaker utters a sentence S is to determine a function from C to truth-values, which maps a given w' in C to φ_S(w').

[1] This is for expository reasons. We believe that our conclusions are compatible with other conceptions of incremental presupposition evaluation, but space restrictions preclude full discussion.

Schlenker suggests that before processing any sub-expression *E* of *S*, the comprehender simplifies their task as much as possible by disregarding those worlds in C where they can be sure that the meaning of *E* does not affect the truth-value of φ_S. Particularly crucial for us is Schlenker's assumption that local contexts are preferably computed incrementally as a sentence is processed left-to-right. The consequence is that the computation of the local context for *E* takes into account information provided by sub-expressions of *S* which precede *E*, but not by sub-expressions of *S* which follow *E*.

To make this more concrete, consider how local contexts are computed as a conjunction *S_1 and S_2* is processed. According to the classic truth-table for conjunction, the proposition *S_1 and S_2* expresses ($\varphi_1 \wedge \varphi_2$) is true in a world just in case the proposition *S_1* expresses (φ_1) and the proposition *S_2* expresses (φ_2) are both true in that world. So:

(3) The comprehender's task as they process *S_1 and S_2* is to construct a function from C to truth-values, which maps a given w' $\in$ C to 1 iff $\varphi_1(w') = \varphi_2(w') = 1$.

Note that in worlds in which one conjunct is false, the conjunction is false independent of the truth-value of the other conjunct. This means that φ_2 affects the truth-value of $\varphi_1 \wedge \varphi_2$ only in worlds in which φ_1 is true, and vice versa. This has important ramifications for how local contexts are incrementally determined.

Specifically, we can distinguish two stages of the incremental parse of *S_1 and S_2*:

(4) [0] S_1 and [1] S_2.

The comprehender first processes *S_1*, beginning at stage [0]. At this point, the comprehender knows nothing about the rest of the sentence and so has no information they can use to identify worlds in C in which φ_1 will not affect the truth-value of the sentence. Thus, the local context for *S_1* is C itself.

As the comprehender sets out to process *S_2* at stage [1], they have already seen *S_1* as well as the connective *and*. Having processed *S_1*, they can identify those worlds in C in which φ_1 is true, and those worlds in C in which φ_1 is false. By (3), φ_2 can affect the truth-value of the sentence only in those worlds in which φ_1 is true, and the comprehender restricts the domain to that subset of worlds in C in which φ_1 is true when they process *S_2*. This is the local context for *S_2*. To summarize:

(5) **Local contexts in a conjunction *S_1 and S_2*:**
   a. The local context for *S_1* = the global context set, C.
   b. The local context for *S_2* = C $\cap$ φ_1

Under what we take to be the central tenet of the processing account – that presupposition evaluation proceeds incrementally – it is expected that presuppositions are evaluated relative to the local context for the clause which contains the expression triggering the presupposition, (6).

(6) **Incremental presupposition evaluation in a conjunction *S_1 and S_2*:**
   a. A presupposition triggered in *S_1* is evaluated relative to the local context for *S_1*.
   b. A presupposition triggered in *S_2* is evaluated relative to the local context for *S_2*.

2.2 Asymmetric projection in (1)

Asymmetric projection follows from (5) and (6). We illustrate with (1), beginning with (1)a, where the presupposition is triggered in the first conjunct.

(1)a [0] The king of Tajikistan is bald, and [1] Tajikistan has a king.

The comprehender sets out to process S_1 at stage [0], and the local context for S_1, as per (5)a, is the entire context set, C. The definite description triggering the presupposition that Tajikistan has a king occurs in S_1, so the presupposition is evaluated relative to the local context for S_1, i.e. relative to C, as per (6)a. For the presupposition to be satisfied, it must be true in all worlds in C that Tajikistan has a king. That is, (7) must hold:

(7) $C \subseteq \{w' : \text{Tajikistan has a king in } w'\}$

Because the presupposition places a constraint on C in (1)a, it is felt to project.

Now, consider (1)b, where the order of the conjuncts is permuted:

(1)b [0] Tajikistan has a king, and [1] the king of Tajikistan is bald.

The definite description triggering the presupposition is in S_2, rather than S_1. The comprehender sets out to process S_2 at stage [1]. As per (5)b, the local context for S_2 is that subset of C containing only those worlds in which φ_1 is true. In (1)b, S_1 expresses the proposition that Tajikistan has a king, so the local context for S_2 is C_2 in (8):

(8) $C_2 = C \cap \{w' : \text{Tajikistan has a king in } w'\}$

The presupposition triggered in S_2 is evaluated relative to C_2, as per (6)b. For the presupposition to be satisfied, it must be true in all worlds in C_2 that Tajikistan has a king. That is, (9) must hold:

(9) $C_2 \subseteq \{w' : \text{Tajikistan has a king in } w'\}$

To understand why the presupposition is felt not to project, it is crucial to note that (9) necessarily holds independent of the make-up of C. Because C_2 is computed from C as in (8), even if C includes worlds in which it is false that Tajikistan has a king, C_2 only includes worlds in which it is true that Tajikistan has a king. The presupposition introduces no constraints on C, and in this way, does not project.

3. Extension to disjunction

In this section, we consider what the system predicts for disjunction. We spell-out how the processing assumptions from section 2.1 apply in disjunction, and show that it follows from them that asymmetric projection is predicted in (2), contrary to fact.

3.1. Processing assumptions

Following from the classic truth-table for disjunction:

(10) The comprehender's task as they process *either S_1 or S_2* is to determine a function from C to truth-values, which maps a given w' to 1 iff $\varphi_1(w') + \varphi_2(w') \geq 1$.

Given (10), if a disjunct is true in a world, the entire disjunction is true in that world independent of the truth-value of the other disjunct. φ_2 affects the truth-value of $\varphi_1 \vee \varphi_2$ only in worlds in which φ_1 is false, and vice versa.

The comprehender sets out to process S_1 at stage [0] in (11):

(11) [0] Either S_1 [1] or S_2.

If *either* is present, the comprehender discovers very quickly that the sentence is a disjunction. This gives the comprehender enough information to know that they *could* restrict the domain to that subset of C containing only those worlds in which φ_2 is false when they process S_1. However, the comprehender has not yet seen S_2, and without having seen S_2, there is no way for them to identify which worlds are those where φ_2 is false. The local context for S_1 is thus the entire context set, C, as in conjunction.

Things, again, change at stage [1]. By this point, the comprehender has processed S_1, so can identify those worlds in C in which φ_1 is true and those worlds in C in which φ_1 is false. φ_2 affects the truth-value of $\varphi_1 \vee \varphi_2$ only in worlds in which φ_1 is false, and so the comprehender restricts the domain to those worlds when they process S_2. The result:

(12) **Local contexts in a disjunction *either S_1 or S_2*:**
   a. The local context for S_1 = the global context set, C.
   b. The local context for S_2 = $C \cap \neg\varphi_1$

Comparing (12) with (5), in conjunction, the local context for S_2 is that subset of C containing worlds in which φ_1 is *true*, while in disjunction, the local context for S_2 is that subset of C containing worlds in which φ_1 is *false*.

Whereas the computation of local contexts depends on the truth-table of the connective, and so works somewhat differently in conjunction and disjunction, incremental presupposition evaluation is entirely dependent on linear order. The result is that (6) extends without modification to disjunction:

(13) **Incremental Presupposition evaluation in a disjunction *either S_1 or S_2*:**
   a. A presupposition triggered in S_1 is evaluated relative to the local context for S_1.
   b. A presupposition triggered in S_2 is evaluated relative to the local context for S_2.

3.2 Asymmetry incorrectly predicted in (2)

Without additional provisions (see Schlenker 2009:38, a.o.), it follows from (12) and (13) that presupposition projection in disjunction is predicted to be asymmetric, like in conjunction. Consider (2)a, where the presupposition is triggered in the first disjunct:

(2)a [0] Either the bathroom is in a funny place, or [1] there is no bathroom.

By (13)a, the presupposition is evaluated relative to the local context for S_1. By (12)a, the local context for S_1 is C. The presupposition constrains C to conform to (14), and thus projects.

(14) $C \subseteq \{w' : \text{there is a bathroom in } w'\}$

Compare with (2)b, where the presupposition is triggered in the second disjunct:

(2)b [0] Either there is no bathroom, or [1] the bathroom is in a funny place.

By (13)b, the presupposition is evaluated relative to the local context for S_2. By (12)b, the local context for S_2 is that subset of C containing only those worlds in which φ_1 is false. S_1 expresses the proposition that there is no bathroom, the negation of which is that there is a bathroom. So, the local context for S_2 is C_2 in (15).

(15) $C_2 = C \cap \{w' : \text{there is a bathroom in } w'\}$

For the presupposition to be satisfied, it must be the case that it is true in all worlds in C_2 that there is a bathroom, (16).

(16) $C_2 \subseteq \{w' : \text{there is a bathroom in } w'\}$

Because C_2 is that subset of worlds in C in which it is true that there is a bathroom, as per (15), the presupposition is satisfied even if C includes worlds in which it is false that there is a bathroom. The presupposition places no constraint on C, and does not project.

The prediction of no projection in (2)b is accordant with empirical fact, but the prediction of projection in (2)a is not. The presupposition does not project in either (2)a or (2)b. Does this problematic prediction for disjunction mean that incremental presupposition evaluation must be abandoned, and with it the explanation for asymmetry in (1)? In the remainder of the paper, we focus on disjunction. We argue that the problem is only apparent, and demonstrate experimentally that disjunction is in fact supportive of incremental presupposition evaluation.

4. Confound

As a first step, we follow Schlenker (2008) in noting that there is a confound in (2) which interferes with the presupposition projecting (cf. also Gazdar 1979). Due to this confound, looking for projective asymmetry in (2) is not as straightforward as it might appear at first sight. Because the presupposition in (2) (that there is a bathroom) is equivalent to the negation of the non-presupposing disjunct (that there is no bathroom), if the presupposition projects, the requirement to satisfy the presupposition comes into conflict with an independent felicity constraint on disjunction, (17).

(17) **Non-Opinionatedness (NO)**
For a speaker to felicitously utter S_1 *or* S_2 the speaker cannot be opinionated about the truth-value of either φ_1 or φ_2.

NO follows from Gricean reasoning. If the speaker believes that φ_1 is true, asserting a sentence which expresses $\varphi_1 \vee \varphi_2$ is blocked by Grice's maxim of quantity since φ_1 is stronger, hence more informative. If the speaker believes that φ_1 is false, they must believe that φ_2 is true to believe $\varphi_1 \vee \varphi_2$. By parity of reasoning, asserting a sentence which expresses $\varphi_1 \vee \varphi_2$ is blocked by the possibility of asserting a sentence which expresses φ_2. Thus, Grice's maxim of quantity rules out a sentence which expresses $\varphi_1 \vee \varphi_2$ when the speaker believes φ_1 to be true or false. Parallel reasoning applies when the speaker is opinionated about φ_2.

If the presupposition projects in (2), for the presupposition to be satisfied, it must be true in all worlds in C that there is a bathroom. If it *is* true in all worlds in C that there is a bathroom, then the speaker is clearly opinionated as to the existence of a bathroom. This results in the speaker being committed that the other disjunct in (2) is false. NO is thus violated if the presupposition projects. This problem is fully general for any disjunction with a profile like (2) where the presupposition triggered in one disjunct is equivalent to the negation of the other disjunct.

To avoid this clash, assuming that NO is dominant, the presupposition needs to be canceled. One mechanism that can be used to accomplish this is *local accommodation* (Heim 1983). Local accommodation of a presupposition effectively gives that presupposition the same status as the at-issue content and conjoins it with the at-issue content of the clause containing the expression that triggers it. If NO does force local accommodation of presuppositions triggered in disjunctions of the profile instantiated by (2), it is unsurprising that they are not felt to project. Thus, testing for whether presuppositions can introduce admissibility conditions on the context of such disjunctions is not a suitable strategy to assess theories of presupposition projection — irrespective of whether they have an incremental component or not.

5. Re-evaluating predictions for (2)

Despite NO interfering with projection in examples like (2), we argue that these examples can be used as testing ground for incremental presupposition evaluation once we re-consider what the approach predicts for (2) when NO is taken into account.

For (2)b, the prediction does not change from that discussed in section 3.1. The local context relative to which the presupposition is evaluated is that subset of C containing only those worlds in which there is a bathroom, and the presupposition does not project.

The important case to re-evaluate is (2)a:

(2)a [0] Either the bathroom is in a funny place, or [1] there is no bathroom.

The presupposition triggered in S_1 is evaluated relative to C, and should place the constraint on C in (18), repeated from (14).

(18) $C \subseteq \{w' : \text{there is a bathroom in } w'\}$

This is where NO becomes important: if (18) were to hold, the speaker would be opinionated that φ_2 is false, so to respect NO, the presupposition must be locally accommodated. Consider, though, how this comes about in the incremental parse.

By incremental presupposition evaluation, the comprehender evaluates the presupposition before they encounter S_2. At this point, the comprehender cannot anticipate that S_2 will have as its asserted content that there is no bathroom, and as such, the comprehender cannot anticipate that (18) conflicts with NO. Because local accommodation is a last-resort option pursued only when projection is impossible (Heim 1983), the comprehender will assume that the presupposition projects.

As the parse continues, the comprehender encounters S_2. When this happens, it becomes clear that (18) does conflict with NO, and the comprehender then revises their assumption of projection, cancelling the presupposition via local accommodation. (For a related approach, see Lassiter 2009.)

With NO considered, neither (2)a nor (2)b are expected to presuppose that there is a bathroom — but the way this comes about is different in the two orders. In (2)b, the presupposition is satisfied in the local context relative to which it is first evaluated, so there is no stage of the parse at which the comprehender assumes projection. In (2)a, the comprehender does assume that the presupposition projects when it is first evaluated, and then cancels the presupposition later in the parse. The revised prediction for (2)a and (2)b is thus that the two orders have different processing signatures. We test this prediction experimentally.

6. Experiment 1: Manipulating expectedness

How can we diagnose whether there is an intermediate stage of the parse at which the comprehender assumes that the presupposition projects in (2)a, but not (2)b? A method presents itself when we consider what happens when a sentence carrying a presupposition occurs in a context where the presupposition is not satisfied prior to the sentence.

(19) I'm sorry I'm late. I had to take my dog to the vet.

Suppose that (19), which presupposes that the speaker has a dog, is uttered to a comprehender who has no prior knowledge about what pets the speaker has, so C includes worlds in which the speaker has a dog and worlds in which they do not have a dog. For the presupposition to be satisfied, the comprehender must be willing to grant that the speaker has a dog and adjust C "on the fly" by eliminating those worlds from C in which the speaker does not have a dog. This process of adjusting C to satisfy a presupposition is called *global accommodation*.

Global accommodation would normally occur "without fuss" (von Fintel 2008) in (19) — but it does have its limits.

(20) I'm sorry I'm late. #I had to take my llama to the vet.

Dogs are common pets in our culture, so it is not unexpected that the speaker would have a dog; however, it is unexpected that the speaker would have a llama. Because of this, the comprehender may find it more of an imposition to grant that the speaker has a llama,

and may be unwilling to globally accommodate the presupposition in (20) (cf. Singh et al. 2013). If (20) occurs in the sort of context assumed above for (19), the presupposition fails without accommodation, and (20) is thus degraded.

We can test incremental presupposition evaluation by exploiting the sensitivity of global accommodation to the expectedness of the presupposition. We present participants with disjunctions like (2) in different contexts. In none of our contexts is the presupposition satisfied, but we manipulate whether the presupposition is *expected* or *unexpected* in a given context. Under incremental presupposition evaluation, at any stage of the parse at which the presupposition is assumed to project and the comprehender must therefore entertain global accommodation, the expectedness manipulation should have parallel effects to the contrast between (19) and (20). So, up to the point in the parse that the second disjunct is encountered, disjunctions like (2)a are predicted to be less felicitous in contexts where the presupposition is unexpected. For disjunctions like (2)b, by contrast, where projection is not predicted at any stage of the parse, the felicity of the disjunction should be independent of the expectedness manipulation.

6.1 Design

To bring out subtle differences between disjunctions like (2)a and (2)b, we compare them in a binary preference task. The paradigm is exemplified in (21)-(22) with one of 8 items.

(21) a. **Expected context for (22)**
An out of town relative visits John at his beach house. The relative notices that there is no boat parked at the dock by the house. The relative is surprised. John loves adventure, and always talks about how he worked as a sailor in the Marines when he was young. The relative concludes:

b. **Unexpected context for (22)**
An out of town relative visits John at his beach house. The relative notices that there is no boat parked at the dock by the house. The relative isn't surprised. John has never liked adventure, and always talks about how he hated working as a sailor in the Marines when he was young. The relative concludes:

(22) a. Either John lent his boat to a friend, or he doesn't have a boat.
b. Either John doesn't have a boat, or he lent his boat to a friend.

The target disjunctions in (22)a and (22)b have a similar profile to (2)a and (2)b. The definite description *John's boat* triggers the presupposition that John has a boat, and the disjunct that does not contain the definite description has as its asserted content the proposition that John does not have a boat, the negation of the presupposition.

The contexts in (21) exemplify the experimental manipulation. The context in (21)a represents the expected condition: it does not establish that John has a boat, but gives reasons to expect that he does. The context in (21)b is minimally different: it, again, does not establish that John has a boat, but gives reasons to expect that he does not have one, making the presupposition that he has a boat unexpected.

Participants are presented with *either* the context in (21)a or the context in (21)b, followed by *both* target disjunctions, trigger-first (22)a and trigger-second (22)b. They are asked to select which disjunction sounds more natural in the context. If the felicity of trigger-first, but not trigger-second varies with expectedness such that trigger-first is less felicitous in the unexpected condition, the prediction is that participants will select trigger-first as the more natural disjunction less often in the unexpected condition.[2]

To assess whether there is an expectedness effect independent of presupposition projection, we compare our target disjunctions to the variants in (22)'.

(22)' a. Either John has a boat and lent his boat to a friend, or he doesn't have a boat.
b. Either John doesn't have a boat, or he has a boat and lent his boat to a friend.

The disjunct containing the presupposition trigger is turned into a conjunction with the addition of a new first conjunct whose asserted content is equivalent to the presupposition. The result is that the presupposition is satisfied in the local context relative to which it is first evaluated in *both* (22)'a and (22)'b, so there is no stage at which the presupposition is assumed to project in either order.

Because the presupposition in (22) is equivalent to the negation of the non-presupposing disjunct, the contextual manipulation affects not only the expectedness of the presupposition, but also the expectedness of the non-presupposing disjunct. In (21)a, where it is expected that John has a boat, the non-presupposing disjunct (that John does not have a boat) is unexpected, and vice versa in (21)b. A comparison between (22) and the controls in (22)' allows us to assess whether the expectedness of a given disjunct independent of presupposition plays a role in determining whether that disjunct is preferred to come first or second. Incremental presupposition evaluation critically predicts that the presupposition triggered in the first disjunct in (22)a enhances any independently given expectedness effect.

6.2 Results

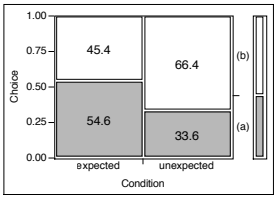
The experimental conditions and the control conditions were run on separate groups of participants, and within those groups, expectedness was manipulated in a Latin Square design. The order of presentation of the trigger-first and trigger-second disjunctions in the binary choice was counter-balanced across trials. The experiment was posted on Amazon Mechanical Turk (scripts from Erlewine & Kotek to appear). The experimental and control versions of the survey were each taken 64 times. We identified participants who took the survey multiple times and excluded all but their first submission; we also excluded participants not self-reporting as native speakers. 8 submissions were excluded.

The relative proportion of experimental (23) and control (24) trials in which participants selected trigger-first (a) vs. trigger-second (b) as more natural in the expected and unexpected conditions is plotted. Plots appear overleaf.

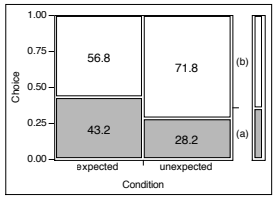
The results for the experimental conditions show an effect of expectedness on the preferred disjunction consistent with the prediction: participants are less likely to select

[2] Because this is an offline task, there is an assumption in generating the prediction that (in)felicity at an intermediate stage of the parse in 1(22)a affects perceived global felicity.

(23) Exp. 1: Experimental



(24) Exp. 1: Control



trigger-first as more natural in the unexpected condition than in the expected condition. Data were analyzed using logit linear mixed effects models. We fitted a model predicting Choice (a vs. b) from Expectedness (expected vs. unexpected) and Order of presentation (a>b vs. b>a, "OP"). The model included item and participant as random effects, and random slopes for the fixed effects.[3] The model confirms a significant main effect of Expectedness ($\beta = 0.64$, $|z| = 3.36$, $p < 0.001$).

The results for the control conditions show a similar expectedness effect ($\beta = 0.39$, $|z| = 2.76$, $p < 0.01$) to the one in the experimental conditions. We note that the expectedness effect in our experimental items is larger ($\Delta = 21\%$) than in our control items ($\Delta = 15\%$), as is predicted if presupposition projection enhances the expectedness effect. However, fitting a model with Expectedness, OP, and Condition type (experimental vs. control) as predictors (with item and participant as random effects with random slopes for Expectedness and Condition type) to the aggregated data does not show a significant interaction between Expectedness and Condition type ($\beta = 0.10$, $|z| = 0.97$, $p = 0.33$, n.s.).

The results are thus consistent with (22)a, but not (22)b involving a stage of the parse at which the presupposition is assumed to project, but they are hardly conclusive, as the crucial comparison of effect size required to isolate an independent role for projection is not significant. Experiment 2 tests for intermediate projection in trigger-first order using a different strategy where intervening factors do not obscure results.

7. Experiment 2: Garden path effect

If there is an intermediate stage of the parse at which the comprehender assumes that the presupposition projects in (2)a and that assumption is revised later in the parse, the processing signature of (2)a is effectively that of a garden path. The processing signature of (2)b, on the other hand, does not involve a garden path, since there is no stage of the parse at which an assumption of projection is predicted. It is reasonable to expect that a parse that involves a garden path would in general be dispreferred to a parse that does not involve a garden path. Experiment 2 exploits this to test our prediction.

7.1. Design

The task is again a binary preference between two disjunctions, though this time, the pair of disjunctions is presented without context. An example item is given in (25)-(26):

[3] Reported models in Exp. 1 and Exp. 2 with Expectedness and OP as the only predictors have random slopes for Expectedness+OP; certain of the models did not converge with Expectedness*OP. Models which include Condition type as a predictor have random slopes for Expectedness+Condition type; models with a random slope also for OP failed to converge. Certain models do show significant main effects of OP and interactions between OP and other predictors, but due to space, we will have to forgo discussion of this.

(25) a. Either Mary's violin was stolen, or she never had a violin.
b. Either Mary's violin was stolen, or she lost her violin.

(26) a. Either Mary never had a violin, or her violin was stolen.
b. Either Mary lost her violin, or her violin was stolen.

The disjunctions in (25)a and (26)a have the same profile as (2)a and (2)b; (25)a is trigger-first, and (26)a is trigger-second. The disjunctions in (25)b and (26)b differ minimally from their counterpart in (a). The disjunct in (a) that contains the presupposition trigger is the same in (b), but the other disjunct is changed so that instead of asserting the negation of the presupposition, it also contains an expression triggering the presupposition. We will refer to (25)a and (26)a as *one-trigger disjunctions*, and (25)b and (26)b as *two-trigger disjunctions*.

Without an explicit context, the task relies on the participant to accommodate an appropriate context. In (25)a, a garden path should arise in accommodation. If the comprehender assumes that the presupposition projects at a first stage of the parse, they will accommodate a context in which Mary has a violin in all worlds in C at that stage. Downstream, when they encounter S_2, they must locally accommodate the presupposition to respect NO and make a revision to their accommodated context to allow worlds into C in which Mary does not have a violin. In (26)a, there is no garden path. When S_1 is processed, the comprehender will straightaway accommodate a context in which C includes worlds in which Mary has a violin and worlds in which she does not to respect NO. The presupposition in S_2 is satisfied in its local context independent of C, so is compatible with the originally accommodated context.

The two-trigger disjunction does not involve a garden path in either order. In (25)b, S_1 is the same as in (25)a, so at the first stage of the parse, the comprehender will do the same sort of accommodation they initially did in (25)a: they will accommodate a context in which Mary has a violin in all worlds in C. Unlike in (25)a, no revision is required in (25)b: S_2 carries the same presupposition as S_1, and so is consistent with the original accommodation. (26b) is similar to (25b): the comprehender initially accommodates a context in which Mary has a violin in all worlds in C, and no revision is required.

On the assumption that a garden path is, all else being equal, dispreferred, we predict that the one-trigger disjunction should be selected less often as the more natural disjunction in the order in (25), where it involves a garden path, than in the order in (26), where it does not.

We, again, try to assess whether including a disjunct that negates a component of the other disjunct has an effect on order preference independent of presupposition. To do this, we use counterparts of our target items, similar to in Experiment 1:

(25)' a. Either Mary had a violin and it was stolen, or she never had a violin.
b. Either Mary had a violin and it was stolen, or she had a violin and lost it.

(26)' a. Either Mary never had a violin, or she had a violin and it was stolen.
b. Either Mary had a violin and lost it, or she had a violin and it was stolen.

Any disjunct where a presupposition is triggered in (25)-(26) is turned into a conjunction with the addition of a first conjunct whose asserted content is equivalent to the presupposition. There is then no stage of the parse at which any presupposition projects, and thus no garden path in any of the four disjunctions — crucially including (25)'a. Any effect in the experimental conditions that is due to projection is predicted to neutralize in the control conditions.

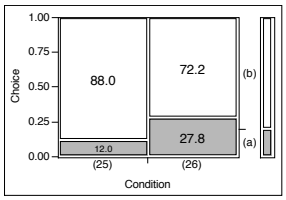
8 items were constructed in analogy to the example item above. In 4 items, as in the example, the presupposition trigger is a definite description. In 4 items, the presupposition trigger is a factive verb. In addition to the 8 experimental items, 12 fillers were created. 2 were disjunctions, and the remaining 10 included 5 conjunctions and 5 conditionals, so the number of disjunctions and non-disjunctions was balanced.

7.2 Results

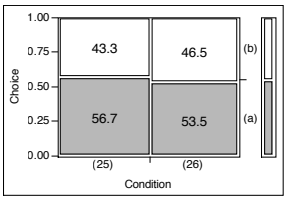
The experimental conditions and the control conditions were run on separate groups of participants. Within the experimental group and the control group, the design was Latin Square. The order of presentation of the one-trigger and two-trigger disjunctions in the binary choice was counter-balanced across trials. Experimental trials and filler trials were interleaved. The experiment was posted as a survey on Amazon Mechanical Turk. The experimental version of the survey and the control version of the survey were each taken 32 times. 12 submissions were excluded by the same criteria as in Experiment 1.

The plots below show the relative proportion of experimental (27) and control (28) trials in which participants selected the one-trigger disjunction (a) vs. the two-trigger disjunction (b) as more natural in (25) and in (26).

(27) Exp. 2: Experimental



(28) Exp. 2: Control



Results from the experimental conditions show an overall preference for the two-trigger disjunction over the one-trigger disjunction, but crucially, there is an effect of condition consistent with the prediction: participants are less likely to select the one-trigger disjunction as more natural in (25) than in (26). We fitted a logit mixed effects model predicting Choice (a vs. b) from Condition (25 vs. 26) and Order of presentation (a>b vs. b>a) with item and participant as random effects with random slopes for the fixed effects. The model confirms a significant main effect of Condition (β = -1.02, $|z|$ = 2.44, $p < 0.05$).

Results from the control conditions confirm that the effect links to projection, as the effect is not observed between the control conditions (β = 0.07, $|z|$ = 0.33, p = 0.74, n.s.). This suggests that, unlike in Experiment 1, there is no more general and potentially projection-independent reason for the effect we observed in our experimental conditions. Indeed, fitting a model with Expectedness, OP, and Condition type (experimental vs. control) as predictors (with item and participant as random effects with random slopes for

Expectedness and Condition type) to the aggregated data shows a significant interaction between Condition and Condition type (β = -0.53, $|z|$ = 3.23, $p < 0.01$).

The results of Experiment 2 provide stronger evidence that there is a stage of the parse at which the comprehender assumes that the presupposition projects in one-trigger disjunctions in trigger-first order, (25)a, but not in trigger-second order, (26)a. The two orders appear to have the different processing signatures our account predicts.

8. Conclusion

This paper presented a solution to a well-known puzzle about projection in co-ordinate constructions: projection in conjunction is asymmetric, while projection in disjunctions like (2) is symmetric. We showed that incremental presupposition evaluation offers a unified account of the conjunction and disjunction facts once a confound in the disjunction data is considered. Given the confound, rather than predicting asymmetry in (2), incremental presupposition evaluation predicts a linear order effect on the processing signature of (2) — a prediction which is supported experimentally.

References

Chemla, Emmanuel, and Philippe Schlenker. 2012. Incremental vs. symmetric accounts of presupposition projection: an experimental approach. *NLS* 20(2), 177-226.

Karttunen, Lauri. 1973. Presuppositions of compound sentences. *LI* 4: 169-193.

Erlewine, Michael Yoshitaka, and Hadas Kotek. To appear. A streamlined approach to online linguistic surveys. To appear in *Natural Language and Linguistic Theory*.

von Fintel, Kai. 2008. What is presupposition accommodation again? *Philosophical Perspectives* 22(1): 137-170.

Fox, Danny. 2008. Presupposition from quantificational sentences: trivalence, local accommodation, and presupposition strengthening. Ms., MIT.

Gazdar, Gerald. 1979. *Pragmatics: implicature, presupposition, and logical form.* New York: Academic Press.

Heim, Irene. 1983. On the projection problem for presuppositions. In *Proceedings of WCCFL 2*, ed. by D. Flickinger et al., 114-125.

Lassiter, Daniel. 2009. Symmetric presupposition satisfaction is mid-sentence presupposition correction. Paper presented at ESSLLI 2009.

Partee, Barbara. 2005. Reflections of a formal semanticist as of Feb 2005. Ms., UMass.

Schlenker, Philippe. 2008. *Be Articulate*: a pragmatic theory of presupposition projection. *Theoretical Linguistics* 34(3), 147-212.

Schlenker, Philippe. 2009. Local contexts. *Semantics & Pragmatics* 2(3), 1-74.

Singh, Raj, Evelina Fedorenko, and Edward Gibson. 2013. Presupposition accommodation is costly only in implausible contexts. Ms., Carleton/MIT.

Stalnaker, Robert. 1978. Assertion. In *Syntax and Semantics* 9, ed. by Peter Cole, 315-322. New York: Academic Press.

Contact: {aronh, hackl}@mit.edu