

# Preconditions and Projection: Explaining Non-Anaphoric Presupposition

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## 1 Introduction

The goal of this paper is to offer a unified account of the triggering and projection behavior of several subclasses of projective meanings, with a focus on two in particular: the veridical implications of factive verbs, and the pre-state implications of change of state (CoS) predicates. The account we offer is pragmatic. We argue that these predicates do not have semantically encoded presuppositions, and in particular do not have a contextual constraint as part of their lexically specified meaning. Instead, we argue that projectivity of these contents is predictable from the detailed lexical semantics of the triggers, in combination with broad pragmatic principles. In describing the account as unified, we mean that we use the same set of principles to explain why these pieces of meaning are projective at all, and why they show the familiar patterns of projection and non-projection that have been discussed in the literature.

A note on terminology: in the current literature, the term *presupposition* is often understood specifically as relating to contextual constraints imposed by use of a lexical item (the *trigger*) or to entailments of the common ground: So factive *know* is a presupposition trigger said to presuppose the truth of the content of its sentential complement. But we follow Simons et al. (2010) in using the more neutral (and empirically based) term *projective content*: the content of the complement of *know* is projective. Projective content is content that a speaker may be taken to be committed to even when the trigger occurs embedded under an entailment canceling

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<sup>1</sup> The authors are listed in alphabetical order; both contributed equally to the development and presentation of this research. We are grateful to audiences at PhLiP 2022 and the 2022 Amsterdam Colloquium for comments on preliminary versions of the theory developed here, and to Alex Warstadt for several helpful conversations, as well as to David Beaver and Judith Tonhauser, with whom we talked about presupposition and projection during our long collaboration from 2006 to 2018. Craige Roberts is Professor Emerita at The Ohio State University, and Mandy Simons is a Professor at Carnegie Mellon University.

operator (Tonhauser et al. 2018). Such content tends to project from under such operators, though it may not always do so.

A recurring question addressed by observations about linguistic presupposition is this: Why do particular expressions have the presuppositions that they are observed to have? In particular, is this a merely arbitrary fact about the lexicon, or are there systematic generalizations to be made about the relation between ordinary meaning and presupposition. If there are such systematic generalizations, can these generalizations be explained? This question about the source of presuppositions is dubbed the *triggering problem*.

There are several arguments in favor of thinking of presupposition as non-arbitrarily associated with particular contents, arguments which have been rehearsed in the prior literature including Levinson (1983), Simons (2001), and more recently Schlenker (2021). The first argument is cross-linguistic regularity. If presuppositions were arbitrary features of the lexical semantics of words, we would expect to find some degree of cross-linguistic variation in what is presupposed by otherwise equivalent terms. Although there has not been any extensive systematic cross-linguistic study, there are some small scale cross-linguistic explorations (Levinson and Annamalai 1992, Tonhauser et al. 2013) and there is much anecdotal evidence, and this all indicates that broadly speaking, expressions across languages that are equivalent in their semantic content give rise to the same presuppositions.

The second, related argument is that within a given language, expressions with commonalities in semantic content give rise to parallel presuppositions: for example, veridical predicates (verbs which entail the truth of their clausal complements) tend to generate projection of the truth of their complements (although to different degrees); and the pre-state, but not post-state, of all change of state (CoS) predicates is projective. Moreover, it doesn't matter whether a particular content is expressed by a single lexical item or by a more complex phrase. Presuppositions are nondetachable (Simons 2001): the expression of a particular content in a particular context triggers presupposition, regardless of the form used. This point is firmly established by Schlenker and colleagues (Tieu et al 2019, Schlenker 2021), whose experimental work shows that novel, nonlinguistic communicative signs also generate presuppositions, which again are parallel to the presuppositions of semantically related linguistic expressions. Like the

observation of cross-linguistic regularity, these observations strongly support the conclusion that what is presupposed (or projective) should be predictable from semantic content.

This conclusion motivates the search for a non-stipulative account of triggering. Such an account should accomplish at least two things: first, provide a general schema which says, given a particular semantic content, what, if anything, will be presupposed. And second, explain why these contents have the status of being presupposed (projective) as opposed to, say, merely entailed or implied. The literature contains numerous attempts to give triggering accounts that do one or both of these things, sometimes for presupposition in general, and sometimes for specific cases. While this list is not exhaustive, it is representative: Kempson (1975), Wilson (1975), Boër and Lycan (1976), Karttunen and Peters (1979), Atlas and Levinson (1981) (for clefts), Grice (1981) (for definite descriptions), Levinson (1983), Chierchia and McConnell-Ginet (1990), Kadmon (2001), Simons (2001), Atlas (2005) (see also many earlier works by Atlas), Abusch (2002, 2010), Abrusán (2011a,b), Romoli (2014) and Schlenker (2021). Current attempts to address the triggering problem tend to focus on what are dubbed *soft* presupposition triggers (Simons 2001, Abusch 2002). Soft triggers are characterized as those whose presuppositions are relatively easy to suppress given conflicting contextual information, but this criterion has never been clearly operationalized, and current experimental work (Tonhauser et al. 2018, Tonhauser et al. 2021, Degen & Tonhauser 2022, under review; White & Rawlins 2018) indicates a good deal of variability in strength of projection (a point we return to in section 3.2.2).

In the earlier literature, especially predating the dynamic turn in semantics, several attempts were made to explain presuppositions as special kinds of conversational implications – perhaps a type of conversational implicature – which systematically arise in what we now call (following Chierchia and McConnell-Ginet 1990) the Family of Sentences. These proposals provide a unified account of triggering and projection: The triggering mechanism involves conversational reasoning; the generality of the conversational reasoning across matrix and embedded use of particular contents explains (at least some) cases of projection. Romoli (2015) offers a contemporary version of this kind of approach: He derives certain cases of presupposition as scalar implicatures, and projection falls out as a consequence of the machinery which generates these. (We discuss Romoli’s approach in more detail in section 2.2)

But a distinct line of research has been dominant in the literature on presupposition, focusing not on the triggering problem but on the *projection problem*: the problem of systematically predicting the presuppositional properties of complex sentences. The now standard treatment of projection is the Karttunen/Heim approach (Karttunen 1974, Heim 1983, 1992), which relies on two premises: that presuppositions are constraints imposed by their triggers on the local context to be updated by the expression containing the trigger, and that context update is incremental and systematic.<sup>2</sup> The solution to the projection problem, in this framework, is a matter of properly characterizing the dynamics of context update. This elegant approach to projection integrates the account of presupposition projection with other related phenomena, especially anaphora resolution, and sets a high bar for descriptive adequacy. Most theorists consider the projection problem essentially solved.

The projection literature has ignored the triggering problem; some theorists have doubled down on the claim that presuppositions are conventional, encoded components of linguistic meaning (“I assume there is a presuppositional component of meaning hardwired in the semantics of particular expressions,” (von Stechow 2008, p.138)). For those who consider that the regularity arguments sketched above motivate the idea of a triggering algorithm, the success of the Karttunen/Heim account and its close relatives suggests that whatever account is to be given of triggering must generate presuppositions which can be “fed into” one of the standard projection algorithms. This strategy is adopted by Kadmon (2001) and Abrusán (2011b); Schlenker (2021) makes a similar assumption. These authors, though, do not clearly rise to the challenge of explaining why the conversational principles that make certain implications projective entail that these implications should require satisfaction in the local context.

And indeed the Karttunen/Heim strategy faces a serious empirical problem. There is good evidence that most presupposition triggers do not, in fact, require satisfaction in their local contexts, but are felicitous when used informatively. Tonhauser et al. (2013) develop and apply a diagnostic which tests for this requirement, which they dub “strong contextual felicity”, or SCF.

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<sup>2</sup> The closely related account of van der Sandt (1992) treats presuppositions as anaphoric contents which require an accessible antecedent; our points about the limitations of the Karttunen/Heim approach extend to this also. Schlenker (2009, 2010) develops a static treatment of presupposition utilizing an alternative conception of local contexts, but similarly assumes that (i) presuppositions are compositionally associated with sentence subparts and (ii) the presupposition of any sentence constituent must be entailed by its local context.

On the basis of their diagnostic, projective contents associated with triggers which have been argued on independent grounds to be anaphoric (including *too*, prosodic focus, and pronouns) turn out to be +SCF, while a wide range of other projective contents tested are –SCF (e.g., see Spender 2003; Tonhauser 2015; Degen & Tonhauser 2022). Taking this seriously means that the Karttunen/Heim account of projection *cannot* provide an adequate account of the projection behavior of these projective contents. The literature currently lacks any satisfactory account of projection for non-anaphoric triggers.

However, the Karttunen/Heim account clearly *does* provide a satisfactory and insightful treatment of anaphoric (+SCF) triggers. In this paper, we indeed assume that their general approach to local context update is correct, and that theirs is the correct account for +SCF anaphoric triggers. Moreover, we note that, with an important exception to be discussed in section 4, the same constructions give rise to presupposition filtering in the same way for both anaphoric and non-anaphoric triggers. This suggests a third desideratum for an account of triggering: addressing the *filtering problem*. As well as explaining the systematicity of projective content, and the standard patterns of projection, an account should explain why anaphoric and non-anaphoric triggers tend to be filtered in the same constructions, for the most part in the same way. We will argue below that this is because both are sensitive to properties of the local context, although in different ways.

Our goal in this paper, then, is to provide a unified account of the projectivity of a particular subset of the non-anaphoric triggers, again delineated in terms of the Tonhauser et al. (2013) taxonomy. On the basis of further diagnostics, Tonhauser et al. make a second cut in the set of projective contents, distinguishing those that obligatorily contribute to local content (having *obligatory local effect*, or +OLE), and those which do not. Roughly speaking, presuppositions which are (also) entailments of their triggers are all +OLE. (This contrasts, for example, with the constraints associated with anaphoric triggers and with the contents of appositives.) In this paper, we focus on two major subclasses of these –SCF/+OLE triggers: factives and change of state (CoS) predicates.<sup>3</sup>

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<sup>3</sup> We follow Stalnaker (1974) and Beaver (2010) in rejecting the factive/semi-factive distinction, so we include Karttunen's semi-factives under the factive heading. The class of factives, as we understand it, includes all predicates which entail the truth of their complements and whose complements tend to be projective to some degree.

The paper proceeds as follows. In section 2, we characterize the projective contents of factives and CoS predicates as entailments characterizing ontological preconditions of the event type denoted by the predicate; we provide linguistic diagnostics for this class of entailments, and observe that an additional significant class of projective contents, the selectional restrictions of verbal predicates, also fall under this characterization. In section 3, we lay out our account of why these entailments are projective, and also of why projection is suppressed in a variety of contexts. In this section, we also discuss the issue of conventionalization, and of variability in projection. In section 4, we extend the discussion of projection and non-projection to give an account of filtering, one which shows why the filtering of non-anaphoric projective contents for the most part mirrors that of anaphoric contents, even though the former are not subject to any anaphoric constraints. In section 5, we conclude.

## 2 Triggering: Projective Implications and Event Preconditions

We borrow from the literature on ontological dependence (see e.g. Tahko & Lowe, 2020) the notion of an ontological precondition: An *ontological precondition* of a specific eventuality  $E$  is an object or eventuality on whose existence the existence of  $E$  depends. The literature distinguishes between two kinds of ontological dependence. The first is *rigid ontological dependence*:  $a$  is rigidly ontologically dependent on  $b$  iff  $a$  exists iff  $b$  exists. A classic example of this is the ontological dependence of sets on their members. For example, the set containing Mandy Simons requires for its existence that the specific individual Mandy Simons exists. Similarly, the event of Julius Caesar dying rigidly ontologically depends on the existence of Julius Caesar.

The second type of ontological dependence is *generic ontological dependence*; this is a relation between an object/event  $a$  and some *class* of objects or events with a particular property  $F$ . Specifically,  $a$  generically ontologically depends on the class  $F$  iff  $a$  exists only if some  $F$  exists. A classic example here is the ontological dependence of electricity on electrons. The existence of electricity does not require the existence of any particular electron, but just that the set of electrons is non-empty. Another example is the dependence of a living organism on its cells, which similarly is a dependence not on specific cells, but on there being cells of particular types which make it up.

The ontological preconditions of events are generic in this sense. For example, consider a specific event of Joe Biden leaving Delaware. This depends for its existence on the existence of a prior state of Joe Biden being *in* Delaware. It does not, though, require the existence of any *particular* state of JB being in Delaware; JB could have been previously in Dover or in his house in Wilmington. There just needs to have been some realization of the state of JB being in Delaware.

Within the broad class of ontological preconditions (whether rigid or generic) of an eventuality, we can distinguish preconditions with different sources. Consider again the event of Julius Caesar dying. As noted, one precondition of this event is that Julius Caesar existed. This precondition has its source not in the fact that the event is a dying event, but in the fact that the event involved Julius Caesar. Other dying events lack this precondition, while other events involving JC (such as JC eating) share it. In contrast, the event of Julius Caesar dying also has as a precondition that Julius Caesar was previously alive; and indeed for any *a*, a precondition on the event of *a* dying is that *a* was previously alive. Thus, we can identify the generic ontological preconditions associated with the entire class of dying events.

This generalized notion of generic ontological preconditions of an eventuality turns out to be the notion we need for our purposes. We identify for a given event type *E* (such as events of dying), those types of objects or eventualities *F* such that *any* event of type *E* can exist only if some instance of *F* exists. For example, any event of an agent *a* leaving a location *l* depends on the existence of some state of *a* being at *l*. This is an instance of generic ontological dependence. With this, we define:

The **ontological preconditions of event type *E***: those object/event types on which any event of type *E* is generically ontologically dependent.

Then our thesis is that the projective implications of the verb classes under consideration here, CoS predicates and factives, characterize ontological preconditions of the associated event type.

## 2.1 Diagnostics for Ontological Preconditions

The relation of ontological dependence is ontological, not semantic. Ontological preconditions as defined above are conditions on the existence of events, not on the truth or falsity of sentences describing events. Knowledge of these relations is world knowledge, not linguistic knowledge.

Nonetheless, ontological dependence has semantic consequences. If S1 describes an eventuality  $e$ , and S2 describes a precondition of  $e$ , then S1 entails S2. However, not all entailments of a sentence describe preconditions. In this section, we describe and illustrate two diagnostics which enable us to distinguish between entailments which characterize preconditions, and those which do not. This also provides an opportunity to introduce an additional case of projective content covered by the current proposal: selectional restrictions.

*Diagnostic 1: is part of what allows/allowed for*

Diagnostic frame, with target clause  $\phi$  and target implication  $\psi$ :<sup>4</sup>

**$\psi$ , which is part of what allows/allowed for  $\phi$**

Note: If the target verb  $V$  in  $\phi$  is atelic, substitute *come to V*, making it inceptive.

Test: If  $\psi$  is an ontological precondition of  $\phi$ , the sentence is judged true; if  $\psi$  is implied by  $\phi$  but is not a precondition of it, the sentence is judged false.

### Illustrations:

- (1) With telic change of state predicate *fall off*; target implication, ‘[agent] was on the ladder’; control implication, ‘[agent] was off the ladder’:
  - (a) Jane was on the ladder, which is part of what allowed for Jane to **fall off** the ladder. (T)
  - (b) Jane was off the ladder, which is part of what allowed for Jane to **fall off** the ladder. (F)
- (2) With atelic factive predicate *know*; target implication, ‘Strasbourg is in France’; control implication, ‘Yasmin believes that Strasbourg is in France’:
  - (a) Strasbourg is in France, which is part of what allowed for Yasmin to come to **know** that Strasbourg is in France. (T)
  - (b) Yasmin believed that Strasbourg is in France, which is part of what allowed for her to come to **know** that Strasbourg is in France. (F)

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<sup>4</sup> Thanks to Janice Dowell (p.c.) for a question which led to an improvement in this diagnostic.

The addition of *come to V* in (2b) yields a telic, inceptive interpretation of the atelic predicate. We'll see the importance of using the inceptive after introducing our second diagnostic.

*Diagnostic 2: counterfactual*

Diagnostic frame, with target predicate (and its complement) *VP*, target implication  $\psi$ :

**If not- $\psi$ <sub>subjunc</sub>, it would not have been possible for [agent] to *VP***

If the target verb *V* in  $\phi$  is atelic, substitute *come to V*, making it inceptive.

Test: If  $\psi$  is an ontological precondition of the target sentence, the counterfactual is judged true; if  $\psi$  is implied by  $\phi$  but is not a precondition of it, the counterfactual is judged false.

**Illustrations:**

- (3) With change of state predicate *fall off the ladder*; target implication, '[agent] was on the ladder': control implication, '[agent] was off the ladder':
- (a) If Jane had not been on the ladder, it would not have been possible for her to fall off the ladder. (T)
  - (b) If Jane had not been off the ladder, it would not have been possible for her to fall off the ladder. (F)
- (4) With atelic factive predicate *knows that Strasbourg is in France*; target implication, 'that Strasbourg is in France'; control implication, 'that [agent] believed that Strasbourg is in France':
- (a) If Strasbourg were not in France, it would not have been possible for Yasmin to come to know that Strasbourg is in France (T)
  - (b) If Yasmin did not believe that Strasbourg is in France, it would not have been possible for her to come to know that Strasbourg is in France. (F)

Now we can see the importance of *come to* in the diagnostics, contrasting its use with atelic *know* in (2b) and (4b) with the versions without *come to* in (2'b) and (4'b) below:

- (2'b) Yasmin believed that Strasbourg is in France, which is part of what allowed for her to **know** that Strasbourg is in France. (T)

- (4'b) If Yasmin did not believe that Strasbourg is in France, it would not have been possible for her to **know** that Strasbourg is in France. (T)

Using atelic *know* instead of *come to know* allows for a different, true reading of the counterfactual. On this reading, the believing event is understood to be a mereological part of the knowing event; the sentence is true on this reading because believing is a necessary part of knowing. The reading is available here, but not with the telic *come to know* variant, due to the way in which event times of atelic predicates are construed (Hinrichs (1981, 1982), Partee (1984), Dowty (1986)). By using the formulation *come to V* in (2b) and (4b), we guarantee an inceptive, telic reading of the relevant target clauses, which gives readings in which the inception of the knowing is understood to come about in the context of a pre-existing belief state (Dowty 1986). In particular, the counterfactual (4b) asserts that the knowing could not have come about were it not for the believing, which is false.

We can also use these two diagnostics to identify the (implied satisfaction of) selectional restrictions of predicates as ontological preconditions. Observe that sentence (5a) entails both (5b) and (5c). The first plausibly reflects a selectional restriction of *kick*.

- (5) (a) The robot kicked the tree.  
(b) The robot has feet.  
(c) The robot touched the tree.

In (6) and (7), we apply our diagnostics to show that (5b) is an ontological precondition of *kick*, but (5c) is not.

(6) *allowed for* diagnostic:

- (a) The robot has feet, which is part of what allowed for the robot to kick the tree. [T, precondition]  
(b) The robot touched the tree, which is part of what allowed for the robot to kick the tree. [F, entailed non-precondition]

(7) counterfactual diagnostic:

- (a) If the robot did not have feet, it would not have been possible for the robot to kick the tree. [T, precondition]

- (b) If the robot hadn't touched the tree, it would not have been possible for the robot to kick the tree. [F, entailed non-precondition]<sup>5</sup>

The case of selectional restrictions has not received much attention in the literature, probably because they are clearly –SCF (though see Beaver 2001 and references therein). But the associated implications are in fact as projective as other –SCF/+OLE projective contents.

Consider:

- (8) Contrary to instructions, the robot didn't kick the tree. (Implies that the robot has feet)  
(9) Philip dropped the davdoodle. Luckily, it didn't smash. (Implies that the davdoodle is made of brittle material.)  
(10) Edna doesn't like me. (Implies that Edna is capable of emotional attitudes.)<sup>6</sup>

In conclusion: These diagnostics were developed because we took the meanings of *allow for* and the counterfactual to capture aspects of what it is to be necessary in a certain sense, one that gets close to the notion of an ontological precondition. This is not to say that there is a perfect match, as shown by the problems discussed in relation to applying the diagnostics to telic predicates. Nonetheless, we find the tests a useful way to support the intuition that semantically relevant distinctions can be made between different entailments.

## 2.2 Prior literature on presupposition triggering

As noted in the introduction, this is far from the first attempt to provide a general account of the presuppositions of particular lexical items. Here we briefly review some of the most discussed recent proposals in the literature, in particular considering them in relation to the classes of predicates we focus on here.

There are two extant accounts of triggering from non-anaphoric triggers which are based on the assumption that these triggers are associated (possibly in the lexicon) with particular sets of alternatives. The first such account, due to Abusch (2002, 2010), is inspired by Rooth's (1992) analysis of focus; the alternative sets in Abusch's theory are construed as analogous to focus-

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<sup>5</sup> Some readers find that this conditional too has a true mereological reading, along the lines of "the robot can't kick the tree without touching it." The addition of *come to V* again eliminates this reading, guaranteeing that the two events are not simultaneous.

<sup>6</sup> Readers can easily check that these implications project in the full Family of Sentences.

alternative sets. She posits that when these sets of alternatives are made salient (either by focus marking, by an overt question, or by a lexical item with an associated alternative set), there is a conversational presumption that the disjunction of the alternatives is true. Anything entailed by the disjunction is treated as a background assumption, that is, as presupposed and projective.

The account is quite elegant in bringing several presuppositional phenomena under one umbrella. The central drawback is that to generate correct results for the factive and CoS triggers, Abusch must stipulate lexically given sets of alternatives whose disjunctions provide the correct entailments. For example, Abusch (2002) requires the alternative of *know* to be the predicate *be unaware* (and nothing else). Assuming that both *know* and *be unaware* entail the truth of their clausal complement, the disjunction of *x knows that p* and *x is unaware that p* entails *p*, as desired.

However, there are no independent reasons for taking these two predicates to be alternatives.<sup>7</sup> In fact, given that the notion of alternatives that Abusch (2002) has in mind is that of focus alternatives, the evidence suggests otherwise. Consider a use of *know* bearing focal stress, as in:

(11) Melinda doesn't *know* that her promotion has been approved.

Natural continuations here might include those in (12):

(12) She just *think/hopes/said* it has.

This suggests that the predicates in (12) are among the salient alternatives to *know*. But because these are non-veridical, Abusch cannot take them to be part of the alternative set. If she did, the resulting disjunction of alternatives would not entail the truth of the complement. Similarly, to generate the correct predictions for *stop*, Abusch must stipulate that the only lexical alternative for *stop* is *continue*, but again without independent evidence. In its application to familiar lexical triggers, Abusch's account thus pushes the explanatory problem back a step, to explaining why the lexical alternatives should be as they are.

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<sup>7</sup> Abusch (2010) does not include factives in her account, and expresses significant reservations about extending the alternatives-based account to expression types for which there is no independent evidence that they generate alternatives.

This explanatory problem is made particularly salient by comparing Abusch's account to the second alternatives-based account, due to Romoli (2015). Romoli's account is inspired by the phenomenon of scalar inferences, and in particular by the analysis of this phenomenon which takes them to be generated by the grammar. Romoli thus envisions alternatives as *scalar* alternatives. The triggers he considers, all non-anaphoric, are "associated with a set of lexical alternatives, of which they are the strongest elements" (p.10). Given how scales interact with negation (and with the exhaustivity *Exh* operator, which Romoli assumes to be responsible for scalar inferences), asserting *Not S*, where *S* contains a soft trigger, will imply the negation of *Not S'*, where *S'* is just like *S* except that the trigger is replaced with its weaker scale-mate. For Romoli to get the correct results for *know*, he must stipulate a different alternative set than does Abusch: for Romoli, the alternative for *know* is (in effect) the clausal complement itself. Romoli acknowledges that this approach leaves the fundamental triggering question unsolved, noting: "The question at this point is of course where the alternatives come from. Notice that this is the triggering problem...in a different guise." (fn.11).

Both Abusch and Romoli share with us the foundational idea that the triggers under consideration are not associated with lexically encoded semantic presuppositions, and therefore do not by virtue of their lexical semantics impose constraints on the conversational context. Both Abusch and Romoli, in very different ways, offer explanations not only of triggering but also of projection. For Romoli, as noted, projection is simply a consequence of the interaction of *Exh* with various operators; hence for him, parallels between projection patterns of non-anaphoric and anaphoric triggers are not directly explained. Abusch, in contrast, takes seriously the need to explain this parallel. To address this issue, she reverts to a Karttunen/Heim-style satisfaction account of projection, although she takes the satisfaction requirement to be triggered by the alternative sets she proposes rather than directly by the lexical item.

Another approach to solving the triggering problem is taken by Abrusán (2011a,b). Abrusán's core intuition has something in common with ours, namely, the idea that it is possible to make systematic distinctions between the entailments of a given sentence. However, while for us the relevant differences between entailments reflect an underlying difference in ontological relations, Abrusán develops her account on the basis of purely semantic relations between sentences. The core idea is that verbal presuppositions are entailments which necessarily have a distinct temporal reference from the main clause of the triggering sentence. The predictions of

her account are thus heavily dependent on the aspectual structure of triggering sentences and of sentences which express their entailments. For example, her account straightforwardly predicts that the preparatory stages of achievement verbs such as *win* will be presupposed when we consider simple past tense sentences such as *Jane won the race*. But Abrusán notes a counterexample (attributed to Mandy Simons): *Jane is winning the race at t*, which entails *Jane is participating in the race at t*. Here, the temporal reference of the two sentences must coincide, hence Abrusán’s account would predict incorrectly that the progressive sentence would not presuppose its preparatory stage. Similarly, one can construct a variety of non-projective entailments for any given sentence that necessarily hold at times distinct from the matrix clause. For *Jane won the race at 2pm*, consider: *Jane would later win the race*, true only at times strictly preceding 2pm; or *Jane had earlier won the race*, true only at times strictly following 2pm.<sup>8</sup> All of these examples suggest that facts about temporal reference are not the essential feature explaining verbal presupposition; in contrast, by invoking ontological preconditions, we capture these cases unproblematically.

Of extant accounts of triggering, the one that appears closest to ours is due to Schlenker (2021), who also aims to give substance to the intuition that presuppositions involve some type of precondition.<sup>9</sup> Schlenker argues for an *epistemic* notion of precondition. The core proposal is that a sentence *S* presupposes *p* just in case a generic agent who learns that *S* is true usually would antecedently know that *p*. Some of the motivating examples are not particularly compelling: Schlenker suggests, for example, that “upon learning that someone unscrewed a bulb

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<sup>8</sup> Abrusán’s account also seems to run into trouble with change of state predicates. Consider *John killed the fly at t1*. For this to be true, the entailment *the fly was alive* must hold of some interval; Abrusán argues that it must hold of an interval prior to *t1*. In addition, *the fly was dead* must hold of some interval. Here, Abrusán claims that as it is coherent to say *John killed the fly, but then it was resurrected*, the reference time of the post-state entailment must be identical to that of the matrix clause. This however seems arguable: in order for John to succeed in killing the fly, there must be some interval, however brief, *after* the killing event in which the fly is dead.

<sup>9</sup> The idea of (some) presuppositions corresponding to preconditions of some sort has several other precedents. To our knowledge, the first such suggestion appears in Simons 2001. Simons suggests that the pre-state and post-state entailments of Change of State predicates (whose symmetry is otherwise a problem for her account) can be differentiated in that the former but not the latter are ontological preconditions of the eventuality. Abusch 2010 discusses a similar idea, suggesting that for predicates whose preconditions must temporally precede the relevant event, the temporal ordering can be invoked to explain projection. (She identifies inchoatives, achievement verbs with prestates, and “agentive verbs such as *sell*” as carrying preconditions.) Note that Abusch considers the identification of preconditions a “semantic” problem for which she suggests no solution. Finally, Thomason et al. 2006 make heavy use of the notion of preconditions as presuppositions, but have in mind preconditions on the realization of communicative intentions. Thomason et al. do not address the triggering problem, and largely assume that presuppositions associated with lexical items such as those discussed here are linguistically encoded constraints.

from the ceiling, one would typically antecedently know that the bulb [*sic*] was on the ceiling.” Other examples are particularly challenging: Consider the sentence *Jane knows that she is in pain*. As pain is a subjective experience, and as to be in pain is to know that one is in pain, it seems that a generic agent could not typically learn of Jane’s pain prior to learning of Jane’s own knowledge of her pain. Yet the complement seems no less projective than in simpler cases. (Thus, *Does Jane know that she is in pain?* is an odd question, suggesting that the speaker knows more about Jane’s pain than Jane.) Schlenker acknowledges that his account is excessively sensitive to context and to the content of particular sentences (e.g. for factives, to the content of the clausal complement); he sketches various possible solutions but leaves a full resolution for later work.

To motivate his triggering account, Schlenker brings together in this paper a wealth of novel cases of presupposition triggering, including cases involving novel, nonlinguistic gestures or signs used communicatively. While we cannot discuss all of his cases here, we would argue that all of these can be accounted for as ontological preconditions.

An important question for both Abrusán and Schlenker is how to connect their triggering proposal to projection. Abrusán (2011b) is explicitly agnostic on this point. She says: “The triggering mechanism looked at atomic sentences. Presuppositions of complex sentences are assumed to be derived by applying a separate projection mechanism. This means that different sets of rules determine how presuppositions are generated, and how they are transmitted” (p.529). Schlenker (2021) suggests an interesting bridge between his triggering algorithm and projection algorithms. Specifically, he suggests that “cognitively inert” aspects of meaning should also be “semantically inert.” On his account, presuppositions, which are known to be true prior to the utterance that triggers them, are cognitively inert; in order for them to also be semantically inert, they should already be entailed by the local context to be updated by the triggering utterance.

### **3 Projection: Why preconditions are projective**

Central to our approach is the idea that triggering and projection are not separate issues. What we have done so far is provide a general *characterization* of the relation between the ordinary content and the projective content of the triggers under discussion. But this is not itself an account of *triggering*. Explaining triggering means explaining *why* the entailments we have

identified should project. Giving that explanation requires us to explain what projection *is* in these cases. In this section, we turn to these questions. We then go on to also explain a variety of cases of *non*-projection, including filtering, using the same explanatory mechanisms. Thus, unlike prior treatments of the triggering problem, we aim to provide a unified and complete account of triggering and projection for the cases under discussion.

Here is a sketch of the general picture that we propose. We assume that the interpretation of an utterance by an addressee requires, among other tasks, identification of the background or context which the speaker is assuming (Sperber & Wilson 1986, Qing et al 2016, Warstadt 2022).<sup>10</sup> We assume further that addressees will select a context which renders the speaker's utterance pragmatically reasonable, with implicit reasoning along the lines of "given that the speaker said *p*, she must have in mind a context entailing *q*." We review extant proposals which offer similar general accounts, and then discuss why in certain circumstances, utterances signal that the speaker indeed assumes the preconditions of events mentioned in the utterance to be part of the context.

### 3.1 Projection in service of informativity

In speculating about the sources of linguistically signaled presupposition, Stalnaker (1974) suggests:

The propositions that *P* and that *Q* may be related to each other, and to common beliefs and intentions, in such a way that it is hard to think of a reason that anyone would raise the question whether *P*, or care about its answer, unless he already believed that *Q*.

Stalnaker plausibly means "raising the question whether *P*" or indicating that one "care[s] about its answer" in a quite general way, so that asserting that *P*, denying that *P*, speculating that *P* and so on would all count as doing one or the other of those things (see Simons 2001). While the suggestion seems promising, it leaves open two questions: What relations between propositions would have this effect? And why?

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<sup>10</sup> For our current purposes, it doesn't matter if you construe context in the now standard way, as the conversational Common Ground; as the speaker's Stalnakerian presuppositions (their beliefs about the CG); or simply as the conversational background assumptions of the speaker (e.g. Lascarides and Asher 2009; Farkas and Bruce 2010).

Some recent work on projectivity in Rational Speech Act (RSA) theory (Qing et al. 2016, Warstadt 2022) can be seen as elaborating on this idea of Stalnaker's in a useful way. These authors aim to answer the most general *why* question: Why are some utterances informative about the context that the speaker is assuming? Most crucially for our purposes, both models demonstrate that utterances (of particular types) can be informative about the context *without* imposing any lexically specified constraints on the context.

Both of these closely related models are developments of the original RSA framework (Frank & Goodman 2012). In these models, a “pragmatic listener” infers the likely intended meaning of an utterance by considering the predictions of their model of the speaker (the speaker model), as well as the probabilities of states of the world and of utterances. The speaker model, in turn, incorporates a model of the “literal listener,” who derives only the literal meaning of an utterance. In addition, the Qing et al. and Warstadt models build on Goodman and Lassiter (2015), where Questions Under Discussion are incorporated as a parameter relative to which the probabilities of utterances are calculated. Listeners now are not simply inferring the likely state of the world given an utterance, but the likely answer to the QUD given that utterance. The central innovation introduced by Qing et al and adopted by Warstadt is the addition of a simple Stalnakerian context set (a set of worlds) as an additional parameter. In the proposed speaker model, the speaker chooses an utterance (with some probability), given three fixed parameters: a world (that they are trying to communicate about); a question (QUD) which is to be answered; and a presumed context. The pragmatic listener in this model then infers simultaneously a pairing of world (representing, in this framework, the state of affairs to be communicated) and context, given the observed utterance and the question. This model thus explicitly represents the task of interpretation as the task of simultaneously constructing the interpretation intended by the speaker and the context being presumed by the speaker.

Qing et al.'s paper focuses on the projective properties of the predicate *stop V-ing*, their central example being the interpretations of *John did not stop smoking*, in a variety of contexts and relative to different QUDs. In their model, *stop smoking* has only its ordinary semantic content and does not impose any lexical constraints on the context in which it occurs. Nonetheless, the model predicts that a listener reasoning about an utterance of *John didn't stop smoking* will often, depending on the QUD, infer that the speaker is assuming a context in which John was previously smoking. These inferences about the context give rise to projection as we

understand it here: an inference about what the speaker is taking to be part of the context. In this model, projection is a consequence of reasoning about a speaker who has produced a particular utterance, given a particular conversational goal (a QUD). This is precisely the model of projection we adopt for the cases under discussion here. (Qing et al.'s model also predicts that projective inferences are sensitive to the QUD, a point we will return to below.) While not all of Qing et al.'s predictions are clearly in line with intuition (as observed by Warstadt), their model provides a proof of concept: that there is a formal model of projection as reasoning about the assumed context with no lexicalized constraints on contextual felicity.

Warstadt (2022) elaborates on the Qing et al. model by explicitly building in the *utility* of the utterance relative to the context and the question: in his speaker model, the probability of a speaker producing an utterance given an intended meaning, a context and a question is proportional to its utility relative to these parameters. As in Qing et al.'s model, a central idea is that the utility of an utterance with meaning *M* varies both with the QUD and with the presumed context.

Warstadt nicely illustrates the sensitivity of utterance utility to context in relation to one of his central examples, an instance of the genus/species presupposition first discussed by Abusch (2002). As Abusch noted, asserting that someone does not have a green card often carries the implication that they are not a US citizen, even though, of course, US citizens are also not green card holders. Abusch noticed that the implication is relatively fragile, and clearly question-dependent. Warstadt's example is *Tom is not an Olympic sprinter*, which, he suggests, gives rise to the implication that Tom is an athlete of some sort, most likely a serious runner.<sup>11</sup> Warstadt explains the implication informally this way: "Olympic sprinters are so rare, that there is almost no utility in asserting that Tom is not an Olympic sprinter in a typical context. Therefore, if a speaker utters [*Tom is not an Olympic sprinter*], the listener may infer that the speaker is assuming a common ground in which it is significantly more likely that Tom could be an Olympic sprinter, for instance a context in which Tom is an athlete of some kind" (p.448). Warstadt then demonstrates that his model generates this prediction.<sup>12</sup>

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<sup>11</sup> The example is perhaps not ideal, as it's easy to hear it as the somewhat jokey "He's no Olympic sprinter!" i.e he is a total couch potato. So we should assume that the speaker is evidently making a serious assertion.

<sup>12</sup> More precisely, the prediction, which is born out, is that the likelihood of inferring that Tom is an athlete of some kind is higher given an utterance of *Tom is not an Olympic sprinter* compared with *Tom is not a runner*.

Let's consider one more example, not modeled by either Qing et al. or Warstadt, but seemingly very similar in structure.<sup>13</sup> Consider an utterance by a speaker of *Jane doesn't know that it's raining*. Suppose that the presumed question being addressed by the utterance is the simple polar question represented in the diagram below, corresponding to *Does Jane know that it's raining?* The diagram represents a non-presuppositional version of the question, including worlds in which it is not raining. The gray blocks in the diagram represent the worlds where the answer to the question is *no*, and the white block, the worlds where the answer is *yes*.  $R$  is the proposition that it's raining,  $K(j,r)$  the proposition that Jane knows that it's raining.

*Does Jane know that it's raining?*

$R \ \&$ $\sim K(j,r)$	$\sim R \ \&$ $\sim K(j,r)$
$R \ \&$ $K(j,r)$	

Because the worlds being partitioned are not restricted to worlds where it's raining (R-worlds), the *no* worlds span both worlds where it *is* raining but Jane doesn't know it, and worlds where it isn't raining at all. Of course, all the *yes* worlds are worlds where it is raining. If the starting information state includes all of these worlds, and assuming that the probabilities are roughly equal, the *no* answer to the question is much more likely than the *yes* answer. In information theoretic terms, this makes the utility of the *no* answer low: given that we don't assume that it's raining *and* we don't know anything about Jane's beliefs, the state of the world in which Jane doesn't know that it's raining is highly likely. Hence, if a speaker utters *Jane doesn't know that it's raining* relative to this context, they have made a rather uninformative assertion.

However, suppose we restrict the question above to R-worlds; that is, we adopt the assumption that it is raining. Now, the likelihood of the two answers becomes more similar, and (in information theoretic terms), the utility of the negative assertion increases. To put it simply:

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<sup>13</sup> We are grateful to Alex Warstadt for discussion of this case.

Learning that Jane doesn't know that it's raining is more informative relative to a context in which it is raining than it is relative to a context in which the question of rain is unresolved. Thus, if the listener, as in the Qing et al. and Warstadt models, is attempting to infer a pairing of interpretation and context which renders the utterance informative, they are likely to infer this more restricted context.

Note that the assertion of the affirmative, *Jane knows that it's raining* is informative relative to either a neutral context (containing both R-worlds and ~R-worlds) or a restricted context (excluding ~R-worlds). Assertion of the affirmative thus does not require the hearer to make any inferences about the speaker's context, although of course acceptance of the assertion requires acceptance of the entailed proposition that it's raining. As there is no projection involved in interpreting this assertion, no more needs to be said.<sup>14</sup>

The account so far provides a general account of (one reason) why hearers modify their model of the context in response to an utterance which does not impose any anaphoric constraints on the context.<sup>15</sup> However, it does not in itself make a prediction about *how* hearers will modify the context; in particular, it does not make a prediction about which propositions hearers will accommodate. This is because the accommodation strategy for improving the utility of the assertion (question) actually works just as well if we restrict the set of worlds with *any* entailment of the proposition that Jane knows that it's raining. For example, if we partition only the worlds in which Jane believes that it's raining into those where she knows it and those where she doesn't (and merely believes), we achieve a similar information theoretic effect. The utility story explains why restricting the context by eliminating the negation of one entailment increases the utility of the assertion; but it doesn't by itself tell us which entailments would be the default entailments to restrict to (Warstadt 2022, p.449).

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<sup>14</sup> This leaves open the question of why an utterance of the affirmative is still judged in some pretheoretic sense to presuppose that it's raining. In our view, this judgement reflects the fact that an utterance of this sentence does not typically make the latter proposition *at issue*. Discussion of this point is beyond the scope of the current paper. See Simons et al. (2010, 2017) and Beaver et al. (2017). Note that we take the correlation between projectivity and at-issueness to pertain primarily to the non-anaphoric triggers, like those under discussion here, though that was not clear in those earlier papers. Anaphoric requirements arguably are not semantic *content*, so it isn't even clear what it would mean for them to be at issue.

<sup>15</sup> Warstadt is hesitant to extend this account very generally, and in particular resists the idea of extending it straightforwardly to change of state predicates or to factives, in light of both the apparent conventionalization of projection in these cases, and some worries about overgeneration.

Warstadt suggests that a partial explanation comes from the listener's prior over worlds. As he puts it, "if a listener is trying to find a likely explanation for a low utility utterance, they should accommodate facts which are more likely *a priori*" (p.449), citing the finding from Degen and Tonhauser (2022) that the likelihood of a projective inference is indeed positively correlated with its prior probability. Similarly, Qing et al. assume that not all context sets are equally likely *a priori*, and use this assumption to constrain the choice of projective implication.

Our observation about the differences between different entailments provides a further piece of the explanation. As we've shown, some entailments reflect preconditions on events, while others are better understood as consequences or concomitants of events. When a speaker introduces a new event E into the discourse, whether to assert or suppose its occurrence, or to ask about its occurrence, they are more likely to have in mind a context which makes true the preconditions of that event than a context which makes true a consequence or concomitant of that event. This makes entailments characterizing preconditions a "safer" default choice for accommodation than other possibilities.

The case just discussed has a further feature which supports the accommodation of the truth of the clausal complement. Note that when the sentence *Jane doesn't know that it's raining* is uttered more or less out of the blue, the default topic is the subject *Jane*. We therefore expect the sentence to provide useful information *about Jane*. Considering whether or not Jane knows that it's raining when we are not already assuming that it is raining is not very likely to contribute useful information about Jane. But if the addressee assumes a context in which it is raining, then the information carried by the utterance is about Jane's cognitive state, contributing information about the topic. This of course is a special feature of *know* sentences, not generalizable across, say, CoS predicates. But the point is that when projection is understood as a broadly pragmatic phenomenon, a matter of the listener trying to make sense of an observed utterance, we should expect a variety of factors, linguistic and otherwise, to bear on projection in a given case. Where world knowledge, in the form of knowledge of ontological preconditions, provides a good candidate for projection in service of informativity, that candidate is a straightforward default solution.

### 3.1.1 Is projection conventional?

As noted, Warstadt (2022) focuses on genus-species presuppositions in developing the RSA model, which he takes to provide a model of “on the fly” pragmatic reasoning. He voices caution about extending the account to the presuppositions of CoSs and factives, on the grounds that “the inferences from these triggers are more indefeasible – and more conventionalized – than genus-species presuppositions” (p.449). We will turn to a detailed discussion of the defeasibility of projection in our core cases in the next section, but to set the stage for the current discussion, let’s preview some well-known examples.

(13) [Context: interlocutors are observing a stranger who is acting irritably and chewing on a pencil. They are speculating about her behavior.]

A: Maybe she just stopped smoking. That’s how I acted when I quit.

(14) [Context: Interlocutors are aware that Bill is trying to find out where his adult daughter has gone to]

If Bill discovers that his daughter is in New York, he’ll be furious. (Chierchia & McConnell-Ginet 1990)

And here’s a naturally occurring example mined by Beaver (2010) (his (29)):

(15) One day Chuang Tzu and a friend were walking by a river.

“Look at the fish swimming about,” said Chuang Tzu, “They are really enjoying themselves.”

“You are not a fish,” replied the friend, “So you can't truly know that they are enjoying themselves.”

“You are not me,” said Chuang Tzu. “So how do you know that I do not know that the fish are enjoying themselves?”

Recounted by John Suler, *Knowing Fish* (undated web page), Department of Psychology, Rider University

As a preliminary observation, we can say this: At least some CoS predicates and some factives can naturally be understood non-projectively in a context which supports such a reading. On the other hand, when a speaker uses one of these predicates in a “neutral” context, projective

readings are automatic and effortless. Moreover, in some cases, which we'll discuss in detail below, the predicates strongly invite a projective reading even in a context which supports non-projection, giving rise to a sense of contradiction. The first observation supports the pragmatic analysis, the second seems to undermine it.

A useful comparison can be made here with the scalar implication associated with *some*, another much debated case. *Some* very robustly carries an implication of 'not more than some,' which sometimes survives even where the implication is inconsistent with world knowledge: In experiments, adult participants judge *Some elephants are mammals* to be false (Bott and Noveck 2004; for related results, see Degen et al. 2015). But as is well documented, *some* is understood without any scalar implication in various kinds of contexts, showing sensitivity, amongst other factors, to the QUD (Degen, 2013; Zondervan, 2010), to the available alternatives (Degen and Tanenhaus 2016), and to the syntactic environment (Degen 2015). There's been much debate in the experimental literature about the timing of the scalar implication (generated immediately or with a delay) and about whether one reading or the other involves more cognitive effort. Although this continues to be debated, the Degen and Tanenhaus research makes a convincing case that the answer to both questions is: It depends. In particular, it depends on the full set of cues available in the utterance and the context.

This observation fits well with the broader model of interpretation argued for in Degen and Tanenhaus (2016, 2019), which they call *constraint based processing* (see also Roberts 2017, 2022). Bringing together broad findings about inference from cognitive science as well as specific results in psycholinguistics, they argue that interpretation is best understood as a process in which "listeners rapidly integrate multiple probabilistic sources of information in a weighted manner" (2019), and in the process of interpretation generate defeasible expectations of multiple types about the discourse. One such defeasible expectation might be that a speaker who uses *some* intends to exclude the parallel *all* claim, an expectation not based on the encoded meaning of *some* but on the listener's familiarity with this pragmatically motivated *use* of *some*. On this picture, *some* is a probabilistic cue of an intended upper bounded interpretation, but does not encode that enriched content. Similarly, we propose that CoS and factive predicates provide a lexical cue that the speaker is treating the preconditions as background assumptions, even though this is not encoded in the lexical meaning as a requirement or constraint.

This claim does not solve the basic question about conventionality. What makes *some* a cue for the associated scalar implication in the first place? If the conventionally (lexically) encoded semantic content of *some* is simply the existential, how could the word itself (or its use) cue the implication? Similarly, if it is the case, as we argue here, that *stop* and *know* do not “come with” a semantic requirement constraining the contexts in which they occur, how can they serve as a cue as to what context the speaker is assuming? Trying to answer these questions might seem to push us back to a traditional type of pragmatic account involving the listener first calculating literal meaning of at least a sentence level constituent, and then engaging in pragmatic inference “on the fly” (as Warstadt puts it) for each individual utterance.

But that would assume a simple dichotomy between conventional, linguistically encoded semantic content and inferential effects. In between these two end points is the nuanced and probabilistic knowledge that language users have about the functions, effects and contexts of use of linguistic forms. A listener can form a strong expectation that a speaker who uses *some* intends to exclude the parallel *all* claim without having a lexical representation of *some* that hardwires the meaning ‘but not all.’ Similarly, a listener can form a strong expectation that a speaker who uses *stop V-ing* is presuming that the pre-state is true, without hardwiring that assumption into the lexical meaning of *stop*.

And where would these expectations themselves come from? This is where the kinds of explanations provided by Gricean reasoning or by the RSA models discussed earlier come in. These models need not be interpreted as models of how each individual utterance is interpreted. Rather, they can be understood to provide the underlying explanation for certain interpretive defaults. To make this more concrete, here is a toy sketch of how such a default might arise.

Suppose that over time a language learner gradually acquiring the meanings of sentences with main verb *leave* (as in *Jane left home early*) observes that the verb describes a particular kind of change of state, a change which they understand to have as pre-state the agent being in the location of the departure. At the same time, they encounter uses of *leave* clauses embedded under operators: *Jane hasn’t left yet*, *If Jane leaves Chicago tomorrow, she’ll get here on Wednesday*, *Jane might have left the school*. Suppose that they approach the interpretation of these sentences using the kind of reasoning modeled by Qing et al., and by Warstadt, and this

reasoning leads them to assign context/interpretation pairings in which the pre-state of *leave* is entailed by the context, interpretations which seem consistent with the speakers' evidently intended meanings.

With enough such exposures, the learner will plausibly develop a probabilistic expectation that a speaker who uses *leave* is assuming a context which entails the relevant pre-state. Perhaps if the learner encountered no counterexamples, they would indeed lead to a lexical model which hardwires this as part of the meaning of *leave*. But assuming they do encounter cases where the QUD or prior contextual information lead to an alternative preferred interpretation (according to the RSA model), then they will maintain only a probabilistic expectation. That is, they will treat the use of *leave* as a defeasible cue regarding the speaker's intended context.

This sketch is not intended as a claim about how *leave* is actually learned, but rather as an illustration of how a pragmatic model can underlie a claim about default meanings or use, or even about linguistic convention. Simons and Zollman (2019) point out that it is a mistake to think that what is conventional is necessarily fully arbitrary, even given Lewis's (1969) notion of convention, and argue that a linguistic regularity may be both conventional and amenable to a historical, cognitive or pragmatic explanation. They call such regularities *natural conventions*. The regularities under discussion here are, crucially, not perfect regularities, or full conventions.<sup>16</sup> But the general line of argument applies just as well: We can recruit pragmatic reasoning to explain facets of linguistic interpretation without committing to the claim that on every occasion where the interpretation is observed, the listener has engaged in the pragmatic reasoning that supports the default. The Simons and Zollman approach can be seen as one way of cashing out the older idea of a short-circuited implicature (Morgan 1978).

Once we understand the projective readings of CoS predicates, factives, and other cases of – SCF/+OLE projection triggers as pragmatically driven defaults, we get a better understanding of how infelicity can arise when such a trigger is used in a context which seems to support a non-projective reading. Given the argument that projective readings arise through pragmatic inference, it seems to follow that if there are contextual cues in favor of a *non-*

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<sup>16</sup> Within the Simons and Zollman framework, they could be modeled as Lewisian conventions with degree  $d < 100$ , or as involving a mixed strategy, but the probabilistic model is more helpful here.

projective reading, that reading should be easily available. This turns out not to always be the case, as we'll discuss in more detail in the next section. The issue, though, is similar to the problem raised by judgements about the Bott and Noveck (2004) type sentences, like *Some elephants are mammals*. Here too, the fact that robust world knowledge doesn't simply switch off the generation of the scalar inference seems problematic for a pragmatic account. However, once we understand the pragmatic account as an account of the source of a default presumption about the interpretation associated with a lexical item, we can see such cases as involving cue conflict, as proposed by Degen and Tanenhaus (2019). Here, the interpreter must resolve a conflict between their pragmatically supported default and world knowledge. If there is no obvious resolution of the conflict, the listener doesn't know what to do, and judges the sentence, at best, as infelicitous. The listener could, indeed, just suppose that the speaker intends to use the sentence with its literal meaning, a use of the sentence which the listener is familiar with from other contexts. Understood in this way, the speaker says something true. But then the listener is left with no good explanation of why the speaker chose to say *some* in the first place. As we consider a listener striving to reach an interpretation consistent with the multiple cues provided by an utterance in context, we need to remember that the listener's goal is to assign an interpretation (including a model of the assumed context) which fully makes sense of the speaker's linguistic choices. Merely avoiding contradiction is too low of a bar for utterance felicity.

We can now finally answer the question posed in the title of this section: Is projection conventional? Our view is that projective readings of CoS predicates, of factives, and of predicates that trigger selectional restrictions, are not conventionally derived, where that is understood to mean hardwired into the meaning of the predicate as the result of arbitrary linguistic choices. We propose that the projectivity of entailments expressing ontological preconditions is explicable in pragmatic terms, as laid out above; but also that projective readings may become well-supported (but defeasible) defaults, so that the presence of a trigger provides a robust cue for the listener about the speaker's presumptions. Hence, global projection becomes the default, as widely attested. And nonprojective readings require not only countervailing cues, but also a context which makes sense of the speaker's lexical choice, given the availability of alternatives. It may be true that some elephants are mammals, but you'd better have a good reason to say so.

## 3.2 Variability in projection

Global projection is the default, but it can be over-ridden in certain contexts. In this section we first (3.2.1) consider *projection suppression*, the non-projection of ontological preconditions in certain types of context. Then (3.2.2) we consider why projection suppression does not always yield a felicitous interpretation, felicitous suppressibility appearing to differ across predicates.

### 3.2.1 Projection suppression: How context sometimes precludes projection

We have argued so far that in the cases under consideration, projection is the result of a listener inferring the speaker's assumptions about the context on the basis of what the speaker has said, given the expectation that the speaker intends to be pragmatically appropriate. In particular, we've argued that when a speaker raises the question of whether an event of type  $e$  has occurred, or will occur, the listener will, other things being equal, tend to take the speaker to assume a context in which the preconditions of that event are true.

But note that, in line with the RSA models just discussed, the listener's goal is not just to construct *any* context that renders the utterance pragmatically sound; their goal is to identify the context assumed by the speaker. Other information about the speaker's intentions and beliefs also guide this process. In this section, we discuss a set of cases where a listener cannot reasonably assume that the speaker had in mind a context entailing event preconditions. These are precisely cases where projection of ontological preconditions is suppressed, and these entailments are understood to be merely locally true (as expected of ordinary entailments). Some of our observations are in line with the results of Qing et al. and of Warstadt showing sensitivity to the QUD. We hold that the pragmatically motivated suppression of projection that we document in this section provides particularly strong support for our overall view of presupposition triggering.

We will consider three types of case where pragmatic features of the discourse situation rule out accommodation of preconditions:

- i. where the precondition is evidently taken by (some of) the interlocutors to be false or controversial,
- ii. where there is other evidence that the speaker is unlikely to be willing to treat the precondition as true,

iii. where the precondition is at-issue.

We illustrate these three cases in turn.

*Case 1: Precondition understood to be false/controversial*

(16) [Context: A & B are American siblings with opposed political views. It is common knowledge between them that B believes that Trump lied about the election being stolen, and that A believes Trump did not lie. The two generally avoid discussing politics, but now they are discussing the fact that B watched all of the public hearings of the January 6<sup>th</sup> committee, while A watched none.]

A: Why should I believe anything these people are saying about Trump? They could say anything.

B: OK. But if the committee discovers that there is proof that Trump knowingly lied to the public, will that change your mind?

A now has to decide whether B intends their utterance to be understood relative to a context entailing that there is proof that Trump lied. If B intended this interpretation, they would be attempting a linguistic move that B knows that A would reject. An alternative interpretation is available, where the existence of the evidence is merely locally entailed (in the antecedent), and not presumed. Given A & B's history of trying not to antagonize each other, it is most plausible that B intends to be so interpreted.

Let's observe two things here. First, global accommodation in this case would not lead to a contextual contradiction, because the interlocutors have been at pains to maintain a context which is agnostic with respect to questions pertaining to Trump's guilt. This shows suppression arises from more nuanced contextual pressures. Second, on this account, there is no need for "local accommodation," as there is no contextual constraint to satisfy. There is merely local entailment, due to the lexical meaning of *discover*.

*Case 2: Evidence of speaker non-commitment*

(17) A: I heard that John got drunk last night.

B: I strongly doubt that. Mary would divorce him if she discovered he was drinking.

B cannot consistently simultaneously *doubt* that John got drunk and *assume* that John got drunk. So A does not take B to be making that assumption; the implication of John drinking is only held to be locally true, in the conditional antecedent. Cases characterized by Simons (2001) as *explicit ignorance cases* are similar:<sup>17</sup> (13) above is another case exhibiting evident speaker non-commitment.

*Case 3: Precondition is at-issue*

Multiple publications (Simons et al. 2010; Beaver et al. 2017; Simons et al. 2017) have argued that the projective contents of factives and change of state verbs fail to project when they are at-issue; experimental evidence for this claim is provided by (Amaral & Cummins 2015; Smith & Hall 2014; Tonhauser, Beaver & Degen 2018; Xue & Onea 2011). The observation is unsurprising given the view of projection we develop here: A speaker cannot reasonably assume that something is true when the question of its truth is currently under discussion in the discourse. For example:

- (18) [Context: The interlocutors know that B is one of Jane’s closest colleagues, with whom she shares details about her professional life. ]  
A: Is there a decision yet on Jane’s tenure case?  
B: I was just talking to Jane, and she isn’t aware that there’s been a decision.

The complement of *aware* would constitute an answer to A’s question. As B has not given a direct answer, she signals that she is unable to do so. But if she is unable to do so, she also cannot coherently presume the answer to the question; hence the hearer must attribute a non-projective reading.

In the examples above, given the non-plausibility of a projective reading, the hearer treats the relevant content as merely locally true. In other cases, where the semantics of a sentence provide an *intermediate* context to which a precondition could be accommodated, we predict that this accommodation will occur where it provides for a pragmatically preferable interpretation. This warrants more detailed discussion, but we limit ourselves here to a single example:

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<sup>17</sup> We now prefer the term *evident ignorance*. As in the examples given here, and indeed in Simons’ original examples, speaker ignorance need not be made explicit, but only needs to be evident to the hearer from the context.

(19) [Context: A and B know that Yasmin’s partner Phil is a US citizen, and that marriage to a US citizen is grounds for citizenship]

A: Is Yasmin a US citizen?

B: I’m not sure. But if she marries Phil, then she could easily become one.

Global accommodation of the pre-condition of CoS *become a citizen*—that Yasmin is not currently a citizen—in this context would be incompatible with the evidence of speaker non-commitment; moreover, the precondition provides an answer to the QUD. The precondition, being entailed by the content of the consequent, must minimally be locally true. But merely taking the precondition to be locally true yields an implausible interpretation: ‘if Y marries P, then she’s not now a US citizen and she can easily become one’. In order for the conditional to express a plausible claim, the precondition is understood as true in the restriction, with intermediate accommodation: ‘if Yasmin is not a citizen and marries Phil, then. . .’.

We see similar instances of intermediate accommodation in irrealis cases, as in (20):

(20) [Context: The interlocutors are talking about their friend Jim, who has recently moved to Washington D.C., where he works as a Spanish teacher. Neither has had much contact with him since he moved. They’ve recently heard, though, that he has a new girlfriend named Maria. They are speculating about how their shy friend might have met her.]

A: Maybe Maria is a Spanish speaker? Maybe somehow they connected through that?

B: I’m not sure, but imagine something like this: Suppose Jim went shopping for supper after work. On his way home, he was waiting to cross the road when Maria came along. Just at that moment she dropped her shopping bag, so Jim stopped to help her pick up her groceries, and they started talking. At first, **Jim didn’t realize that she’s a Spanish speaker**. But once he figured **that** out, he switched to talking to her in Spanish and that’s how things got started.

Observe that here, the precondition of negated *realize* must be accommodated outside the scope of negation to provide an antecedent for the following demonstrative *that*. The precondition cannot, of course, be accommodated globally, again given evidence of speaker non-commitment (*I’m not sure*). Instead, A has to infer that B is constructing a story under the mere hypothetical assumption that Maria is a Spanish speaker. Thus, the background precondition of *realize* is

accommodated to the irrealis context which is being updated with the suppositional assertions made throughout the story.

In summary, the goal of this section has been to illustrate a variety of ways in which contextual cues that signal lack of speaker commitment to the truth of event preconditions lead to natural, felicitous, nonprojective readings of CoS or factive verbs. Projection in these cases, although it does not lead to contradictory contexts, would render the speaker pragmatically unreasonable. The observation that projection in these cases is sensitive to pragmatic (in)coherence supports our contention that projection triggering is itself a consequence of the expectation of pragmatic coherence.

### 3.2.2 Lexical factors in projection and suppression

One might take the account of projection suppression we have just proposed to predict that projection is always felicitously suppressed in one of the contexts just reviewed, with the precondition merely locally entailed. However, that is not the case. The projective contents of certain predicates sometimes seem to resist suppression, instead yielding infelicity in the face of, e.g., explicit speaker ignorance. How can we explain these differences in projectivity?

Approaching the question from a different angle, Karttunen (1971) was one of the first to notice that some predicates are less stubbornly projective than others, distinguishing a class of what he called *semi-factive* predicates, one of which is *discover*. He observed that the truth of the complement of *discover* sometimes fails to project when the predicate occurs in a question or in the antecedent of a conditional, though he thought that when occurring under negation it was always “factive”, i.e., projecting the truth of its complement. In this respect, *discover* appears to contrast with *regret*, as shown in the examples below, due to Karttunen:

- (21) (a) John didn't discover/regret that he had not told the truth.  
(b) Did you discover/regret that you had not told the truth?  
(c) If I discover/regret later that I have not told the truth, I will confess it to everyone.

Karttunen observed that both versions of (21a) (without narrow focus on the verb) imply that the agent hadn't told the truth. The same is true of the *regret* versions of (21b/c). But with

*discover*, neither (21b) nor (21c) carries this implication about the agent<sup>18</sup>. Variability of this sort is a problem for the classical approach to presupposition projection, which predicts projection whenever a presupposition is not locally satisfied.<sup>19</sup> On the basis of these examples, Karttunen proposed distinguishing two different notions of semantic presupposition. In subsequent theories of presupposition satisfaction, like those of Heim (1983) and van der Sandt (1992), it is assumed that in cases with neither global nor explicit local satisfaction, felicitous failure to project must involve local accommodation of the presupposition. But it is unclear why such accommodation should be readily available for one presupposition trigger but not for another: A presupposition just triggers a requirement of satisfaction.

The present account suggests a more nuanced way of approaching these puzzles. We've argued above that the explanation for *why* certain verbs tend to trigger projection lies in the lexical semantics of the triggering predicates and world knowledge about the associated event-types. We think the explanation for variability in projection will similarly lie in the details of the semantics and pragmatics of particular projective triggers and the particular contexts that yield infelicity—always controlling for contextually relevant implications.<sup>20</sup>

As an early example of this kind of explanation, consider Stalnaker's (1974) response to Karttunen's observations. Stalnaker observes that if presupposition is understood pragmatically, lexical differences between the verbs can explain the differences in behavior. With respect to the conditional case in (21c), Stalnaker says (p.57):

[I]f a speaker explicitly supposes something, he thereby indicates that he is not presupposing it, or taking it for granted. So when the speaker says "if I realize later that P," he indicates that he is not presupposing that he will realize later that P. But if it is an open question for a speaker whether or not he will at some future time

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<sup>18</sup> The judgments about (10b) with *discover* are less robust; this seems to allow for a projective reading, given the right background.

<sup>19</sup> Here is another problem: Though in many examples in the literature it seems that global accommodation is preferred over merely local, recent work by Göbel & Schwarz (2023) offers evidence that "globally accommodating a presupposition led to a greater decrease in acceptance than locally accommodating, and that response times for local accommodation were overall faster." This doesn't strike us as a problem for the present account, in which (because the projective contents are entailed) there is no need for local accommodation, only global. But it is unclear how the classical theory can account for this difference.

<sup>20</sup> This is, in fact, the approach proposed by Anand & Hacquard (2014) to explain the tendency to project of the non-veridical *response-stance* predicates.

have come to realize that P, he can't be assuming that he already knows that P. And if he is not assuming that he himself knows that P, he can't be assuming that P. Hence P cannot be presupposed. A roughly parallel explanation will work for *discover*, but not for *regret*.

A similar explanation can be given for the second person question case. So if we look beyond the shared factive entailment to other features of the meanings of these verbs, we can quite easily explain the difference in projectivity.

In giving this explanation, Stalnaker is relying on a difference between *discover* and *regret* that he does not make explicit. As noted by Abrusán (2012), *discover* is a cognitive change of state verb, so that (in our terms) its associated event-type carries two ontological preconditions: the truth of its complement (factivity) and a pre-state in which the agent in question is ignorant of that truth (the pre-state implication of ignorance). Our counterfactual diagnostic confirms that this pre-state is a precondition:

(22) If John hadn't been ignorant of whether the jewels had been stolen, he couldn't have discovered that the jewels had been stolen. [T]

Here, the precondition reflects the fact that the discovery is a change in the agent's doxastic state.

Returning then to Stalnaker's explanation, we can add a further observation. In (21c) with *discover*, the speaker's supposition that she will *later* discover that she did not tell the truth gives rise to projection of the precondition that she is currently *ignorant* as to whether or not she told the truth. That is consistent with the implication of ignorance carried by the use of the conditional antecedent. This doubly supported implication of ignorance is, as noted by Stalnaker, inconsistent with also attributing to the speaker the presumption that she did not tell the truth, hence projection of this implication is suppressed. But as *regret* has no such ignorance presupposition, and because in fact an agent currently aware that *p* can be uncertain as to whether they will in the future regret that *p*, there are no conflicting implications to suppress projection of the factive implication of *regret*.

The lack of projection of the complement of *discover* in (21b) can be similarly explained. Building on Stalnaker's explanation: if the speaker is presuming the complement to be true and expects that presumption to be recognized by the addressee, then they must also be assuming an

affirmative answer to the question. If the hearer is to take this as a genuine question, they cannot attribute this presumption to the speaker. But as with (21c), the ignorance implication that prior to the relevant time in the past, the addressee was ignorant about whether she had told the truth still projects. (21b) clearly implies that the addressee did not knowingly lie in the first place. In (21a) there is no contextual implication that the speaker is ignorant about the truth of the prejacent of negation, so its precondition projects, as does the implication that prior to the event time of the discovery John was ignorant of its truth. Hence, the lack of factive projection with *discover* in (21b/c) is a function of the speaker's implicated ignorance, consistent with one of the suppression contexts discussed above. Thus, the difference between *discover* and *regret*, which Karttunen originally proposed encoding in the lexical entry of the verbs, can be explained by taking into account broader features of their lexical semantics.

The more projective *regret*, of course, is not a change of state verb. However, *regret* does have an ontological precondition, like all the other emotives: One can only regret, resent, be upset or scared by a situation one believes to actually obtain:

(23) If Yasmin didn't believe that she had missed the train, it would not have been possible for Yasmin to regret missing the train. [T]

And it seems that in the absence of an explicit claim that the agent in question is mistaken in that belief, these predicates are taken by default to be veridical. In (23), nothing in the context conflicts with this doxastic/veridical implication, and so it very strongly tends to project.

Below we'll briefly explore two case studies where pairs of triggers display contrasting projectivity, illustrating how subtle differences in lexical semantics result in different tendencies to project in particular contexts. Keep in mind that these triggers are associated with ontological preconditions, that, as preconditions, these implications are projective, and that this projectivity is accordingly a natural convention associated with the triggers. The default understanding is that the speaker assumes that the precondition is true. The question of interest is why some preconditions seem to be more difficult to contextually suppress than others. Our exploration of this bears on the findings from the experimental literature showing that different triggers differ in projectivity even in the absence of contextual information expected to suppress projection (Tonhauser et al. 2018, Tonhauser et al. 2021, Degen & Tonhauser 2022, under review; White & Rawlins 2018).

### *know/discover*

First consider *know* and *discover*, both of which are veridical and both of which describe eventualities for which the truth of the complement proposition is an ontological precondition. See (22) for application of the counterfactual diagnostic for *discover*, and (24) for *know*:

- (24) If it wasn't raining, it wouldn't have been possible for David to come to know that it's raining. [T]

But consider the contrast in (25):

- (25) [Context: the interlocutors are concerned about whether an important delivery might be late, and what they should do if it is.]
- (a) If I discover that the delivery is late, I'll try to contact the shipper.
- (b) #If I know that the delivery is late, I'll try to contact the shipper.

Here, whether the delivery is late is an unresolved question, and the interlocutors' over-arching concern is what to do about this situation. The response in (25a) indicates the course of action the respondent will take if she learns that it is. This strongly implicates that the respondent doesn't know whether the delivery is late, for if she did, she should say so and actually commit to contacting the shipper. Given this, it would be inconsistent with this context to take the complement of *discover* to project; projection of the factive implication is felicitously suppressed, while the ignorance pre-state projects. But (25b), with *know* in the antecedent, is much less felicitous, suggesting that the complement of *know* is not as readily amenable to suppression given evident ignorance. How can we explain this difference?

First, note that despite the contrast illustrated in (25), there are lots of naturally occurring examples in which use of *know* in a suppressive context is felicitous. Beaver (2010) contains a treasure trove of felicitous naturally occurring examples where the truth of the complement of *know*, like that of *discover*, fails to project from under negation, a modal or conditional, even with first or second person agents, in the right kind of context. His example in (15) above involves non-projection of the complement of *know* from under negation, with both first and second person subjects. There, the complement of *know* is merely locally entailed, the result entirely felicitous.

In examples like (25), we would argue that a crucial factor in the differential acceptability is the difference in telicity between the two predicates: *know* is atelic and stative, while *discover* is telic, entailing a change of state from not-knowing to knowing. As argued in Hinrichs (1981, 1982), Partee (1984), and Dowty (1986), in the absence of a temporal adverbial to explicitly shift reference time, the event time of an atelic predicate is understood to overlap the contextually given reference time, while the event time of a telic predicate is understood to (more or less immediately) follow the reference time. Given the stativity of *know*, the event time of the antecedent in (25b) is required to overlap with the reference time given by the QUD, which is the speech time. In other words, the state of knowing supposed in the antecedent clause is a current state. Again, by supposing something in the antecedent of a conditional, a speaker usually indicates uncertainty about its truth. So the speaker indicates that they are uncertain whether or not they currently know that the delivery is late. But this is an odd thing for someone to be uncertain about. The oddity of (25b), then, mostly derives from the oddity of the antecedent, qua antecedent, regardless of projectivity.

In contrast, as usual with a telic predicate, in (25a) the event time of telic *discover* is understood to *follow* the speech time, so its event time is shifted to the immediate or near future. It is entirely possible cognitively, despite one's ignorance whether *p*, to entertain a possible circumstance where one experiences a change of state to one where one knows that *p*. So (25a) is felicitous.

Confirming that the difference between (25a) and (25b) is one of pragmatic oddity in the case where reference time and event time overlap, both past versions are odd (at least on a non-habitual interpretation):

(26) Was the delivery late?

- (a) #If I discovered that it was late, I tried to contact the shipper.
- (b) #If I knew that it was late, I tried to contact the shipper.

Unless the speaker is an amnesiac, presumably she presently knows whether she knew or discovered at a particular relevant past time that the delivery was late.

Moreover, when the reference time is in the future, a bare present in the antecedent of an indicative can have a futurate interpretation. This all suggests that shifting the reference time of *know* forward will improve felicity, which is in fact the case:

(27) [Context: A mother is talking to her daughter, who has decided to drop out of college. The daughter has so far refused to say why but has just promised to explain when she arrives home]

I still have no idea why you're doing this, and I'm glad you're going to tell me. If I know that you're doing it for a good reason, I'll feel more comfortable.

Summarizing, in (25) the difference in felicity between *know* and *discover*, and the pre-state of ignorance associated with *discover*, together have significant effects on what is communicated by the superficially parallel conditional sentences, which explains their differing felicity.

### ***stop/continue***

Another pair of triggers worth comparing is *stop* and *continue*. Kalomoiros and Schwarz (to appear) make heavy use of *continue* in their experimental materials, and it proves there to be stubbornly resistant to suppression in evident ignorance contexts, whereas in our (13) above, *stop* is readily suppressible. Why this difference?

As we saw, *stop* is a CoS verb, with the ontological precondition acting as pre-state, while *continue* is atelic, without pre-state. But still, *continue* shares this ontological precondition of *stop*: One can neither stop nor continue doing something that one hasn't previously been doing, as confirmed by applying our diagnostics to *continue*:

(28) If Yasmin had not been smoking, it would not have been possible for Yasmin to continue to smoke. [T]

With both triggers, when encountered out of the blue, this implication does strongly tend to project from the antecedent of a conditional, as in (29) and (30):

(29) If Yasmin continues to smoke, this has a bearing on her eligibility for life insurance.

(30) If Yasmin stops smoking, this has a bearing on her eligibility for life insurance.

But a difference between the two can be seen by considering the following:

- (31) (a) John smokes.  
(b) John stopped / has stopped smoking.  
(c) John continues to smoke / has continued to smoke.

(31a) could occur near the beginning of a journalist's profile of John. It simply reports that he is in the habit of smoking. (31b) is also natural, forcing the reader to assume that John previously smoked (the precondition), but describing an event (the stopping) which we can imagine to be relevant, for example, to John's current behavior. But (31c) would be odd in such a context; it suggests that the reader is supposed to be able to identify a specific prior period or event time from which time John smoked, perhaps despite some specific occurrence, with the habit continuous in the interim: 'John's father died of lung cancer, but John continues to smoke (since/despite that death)', 'John started smoking in 1978, and he continues to smoke (to this day)', etc. So unlike *stop*, *continue to V* implies that the activity of *V-ing* is on-going from some relevant past time, and thus requires that this prior interval be identifiable by the hearer. And (31c), given with no prior reference to smoking, is odd for another reason, as well. The activity described by *continue V-ing* is no different from that described by plain *V*. For a use of *continue V-ing* to be felicitous in a context, the fact that the activity is a continuation from a salient prior interval or event needs to be contextually relevant. The kinds of contexts which make an event of stopping *V-ing* relevant do not necessarily support felicitous reference to a continuation of *V-ing*.

These two factors help to explain a difference in felicitous projection suppressibility in the following pair:

- (32) [Context: interlocutors are observing a stranger who is acting irritably and chewing on a pencil. They are speculating about her behavior.] Speaker says:  
(a) Maybe she just stopped smoking. That's how I acted when I quit.  
(b) Maybe she continues smoking. That's how I acted when I craved a cigarette.

In (32a), repeated from above, the projection of the pre-state of *stop* is readily suppressed, given the evident ignorance of the speaker. The speaker can still suppose the stopping, and doing so in the context is relevant, as recently stopping (with its consequent withdrawal symptoms) would

explain the stranger's behavior. In contrast, (32b) is odd, even though craving a cigarette is, in principle, as good an explanation for fidgeting as having stopped smoking is for irritably chewing on a pencil. But the two requirements just noted for use of *continue* conspire to render the utterance odd. First, if what the speaker means is that the behavior reflects nicotine withdrawal, she could just as well have said *Perhaps she smokes/Perhaps she's a smoker*, without signaling a salient prior interval of smoking. But that is precisely what is added by the use of *continue*. Because the speaker could have avoided that signal and chose not to, the addressee is faced with a cue conflict; and moreover cannot identify any salient prior interval from which current smoking would be a continuation. In contrast, when the speaker of (32a) wants to suppose a stopping event, there is no way to do so without invoking the pre-state; any way of describing stopping gives rise to the same implication.

Now compare the pair in (33):

(33) [Context: On campus at the beginning of the year, it was determined that a disturbingly large percentage of the student body were smokers. The health center started an intense campaign to educate and encourage smokers to stop, and by the spring it seems to have had a significant impact, reducing the number of smokers. But there are still hold-outs. The health center is conducting studies to understand how the campaign has succeeded, how it has failed:]

- (a) I don't know whether Yasmin smokes. But if she has continued to smoke, she'll be eligible for the new study at the health center.
- (b) I don't know whether Yasmin smokes. But if she has stopped smoking, she'll be eligible for the new study at the health center.

The present perfect denotes a state: in (33a), the state in which Yasmin continues to smoke despite exposure to the campaign over the past year, and in (33b) the result state of her stopping smoking during that year. With this understanding, both *continue* and *stop* are relevant to the conditional consequent; *continue* takes as its anaphoric antecedent Yasmin's presumed exposure to the campaign information; and the examples are fine with the antecedent merely locally entailing that Yasmin had been a smoker in the past, prior to the campaign.

This presumption of a start-date for the period of continuation is arguably a crucial difference between *stop* and *continue*. We offer as a preliminary hypothesis that *continue* is anaphoric, presupposing that prior to the present reference time there was a familiar beginning of the activity. If the anaphora is not locally resolved, the familiarity presupposition, along with its associated implication of smoking, stubbornly projects. This would explain why the preceding smoking-state projects so robustly in the examples with *continue* considered by Kalomoiros and Schwarz, since none of their experimental materials entailed local familiarity of the presupposed start-date.

Space precludes exploring further case studies here. But we note that *discover/stop* and *know/continue* also show such pairwise differences in projectivity, which we believe can be at least partly explained in terms of the features of these predicates' meanings explored in the two case studies above. In constructing these examples, we had to carefully control for several factors, including the felicity of global projection (barred with explicit ignorance); anaphoricity; the relevance of a conditional antecedent to the consequent; aktionsarten, tense and reference time; and world knowledge about the event types under discussion. A host of other pragmatic factors arise as a function of the choice of background assumptions and the pragmatics of the trigger's complement—as we saw in (32a) vs. (33b). In particular cases, to predict the likelihood that a precondition will project *and* the likely acceptability if it cannot felicitously do so, one must carefully consider both the lexical semantics and pragmatics of the predicates *and* how those interact with context, including the QUD and priors. (Amaral & Cummins 2015; Smith & Hall 2014; Tonhauser, Beaver & Degen 2018; Xue & Onea 2011; Degen & Tonhauser 2022) This is exactly what the pragmatic approach we propose would predict.

### 3.3 Summary

In section 2, we presented our argument that the projective contents of factives and of change of state predicates are entailments that characterize ontological preconditions of event types. In the current section, we've offered an explanation of why such entailments tend to be projective. We take accounts of projection in RSA to provide a good proof-of-concept of the general account, and argue that the recognition of the special status of precondition entailments helps to answer a question faced by the RSA proposals, namely, which entailments are projective “by default.” But an important feature of both our account and the related RSA proposals is that this default can be

overridden. As projection, in our account, is pragmatically driven – that is, driven by the hearer’s goal of attributing a plausible interpretation to the utterance – we expect it also to be subject to modification and suppression on pragmatic grounds. In section 3.2.1, we illustrated how such suppression of projection works. And in 3.2.2, we argued that in cases where it seems that suppression of projection leads to infelicity, so that it seems that projection is “stubborn”, the infelicity is actually a result of complex factors in the semantics and pragmatics of the predicates, their tense and aspect, and the ways that these interact with context.

In the next section, we argue that this kind of treatment of non-projection can be extended to deal with a core set of data relating to non-projection, the classic Karttunen filtering environments.

#### **4 Filtering without constraint satisfaction**

A central and very robust finding in the literature on presupposition projection is the observation of presupposition *filtering* originating in Morgan (1969) and systematized in Karttunen (1973). The observation is that the presuppositions even of robustly projective triggers routinely and unproblematically fail to project in certain embedding constructions. The three core cases are illustrated in (34)-(36) below:

(34) Jane used to smoke, and now she’s stopped.

(35) If Jane used to smoke, she’s now stopped.

(36) Either Jane never smoked, or she’s stopped

(34) involves filtering in a conjunction, with the presupposition triggered in the second conjunct entailed by the first conjunct.<sup>21</sup> (35) is the standard case of filtering in a conditional, where the antecedent contextually entails the presupposition of the consequent. (36) illustrates filtering in a disjunction; here, the first disjunct contextually entails the negation of the presupposition of the second disjunct. In the conjunction case, the presupposition of the second clause is of course

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<sup>21</sup> As noted by Karttunen, filtering does not require a strict relation of semantic entailment, but only contextual entailment (see Karttunen 1973 section 9). Karttunen’s observation already sets us on the path to understand filtering in terms of overall pragmatic plausibility of an utterance, which is the idea which we develop here. However, to keep things simple, all of the examples given here will be cases where the antecedent straightforwardly entails, or is identical with, the projective content of the consequent.

communicated by the utterance as a whole; in the conditional and disjunction cases, it is not understood as a commitment of the speaker. These are the cases we focus on here.

The Karttunen/Heim account of projection offers an elegant explanation of filtering, based on the assumption that presuppositions are contents which must be entailed by the local context for the triggering clause. Where the local context just is the global context, then, to be satisfied, presuppositions must be entailed by the global context. This is the case for matrix clauses, for the antecedents of conditionals, and for the first conjunct of a conjunction. However, the local context of the second (or later) conjunct of a conjunction or the consequent of a conditional always contains the content of the earlier conjunct or of the antecedent, respectively. Similarly, according to this account, in a disjunction, the negation of the first disjunct is part of the local context of the second. When these compositionally contributed contents entail a presupposition triggered in the later clause, the presupposition is locally satisfied, and imposes no constraint on the global context, that is, the presupposition does not project.

On the Karttunen/Heim account, presuppositions which are not locally satisfied in the way just described should always project; the triggering clause should be felicitous only if the presupposition is entailed by the global context. Apparent counterexamples involving felicitous informative presuppositions or those which fail to project in contexts like the explicit ignorance context in section 3 are taken to involve accommodation, either at the merely local level, at an intermediate level (possible only if the local context isn't the global context) or at the global level, with global accommodation taken to be the default, preferred resolution (Heim 1983).

We take it that the dynamic theory of context update presumed in such accounts is an important and insightful contribution to our understanding of how context evolves in discourse, including in the course of interpreting a single utterance. And as noted above, for the anaphoric triggers—those which impose a Strong Contextual Felicity constraint—we assume the satisfaction-based account of presupposition satisfaction and projection, with dynamic context update, is basically correct. Anaphoric triggers require antecedents in order to resolve the anaphora.

But as we have emphasized throughout, the –SCF/+OLE projective contents under consideration here are not subject to an anaphoric requirement. Non-anaphoric presuppositions do not directly impose constraints on local context. Hence, the satisfaction-based account gets no

traction on these, including for the account of filtering. However, an account based on incremental context update *will* play a central role in our explanation of filtering for non-anaphoric triggers.

We will argue that the same kind of pragmatic considerations at play in projection suppression (section 3.2.1) do the principal work in filtering projection of preconditions, interacting in systematic ways with the semantic content of the component clauses and the local context for the trigger. The basic idea is that the standard filtering environments are those in which (a) attribution to the speaker of the presumption that a precondition holds is pragmatically implausible and (b) the non-projective reading of the clause *is* pragmatically reasonable in its context. In most cases, then, the resulting filtering patterns will be the same for the –SCF triggers as is seen in anaphoric triggers.

Consider first the conditional case illustrated in (35). Recall that the hearer’s task in interpretation is to simultaneously identify a presumed context and an intended interpretation that will render the utterance pragmatically plausible (informative, relevant etc.). In (35), we need to assess whether by conditionally concluding in the consequent of the conditional that Jane has stopped smoking, the speaker signals a presumption that the global context entails that Jane used to smoke. The answer here is clearly not. Why? Precisely because this assumption is explicitly *supposed* in the antecedent of the conditional, and the function of the conditional structure is to assess the content of the consequent relative to the content of the antecedent. The conditional filtering structure doesn’t merely signal the speaker’s lack of commitment to the content of the antecedent, but also provides a reason for talking about Jane stopping smoking in the absence of the assumption that Jane has smoked – namely, that the speaker is explicitly *supposing* it.

Both this account and a local satisfaction account assume that the consequent is evaluated relative to a dynamically updated context that includes the content of the antecedent. The difference between the two for (35) is this: the local satisfaction account says that there is no projection because the strong contextual felicity condition triggered by *stop smoking* gets contextually satisfied locally and hence no constraint is imposed on the global context. Our account, in contrast, says that hearers need to make sense of a speaker conditionally concluding that Jane has stopped smoking; and that where the background assumptions that make it sensible to do so are explicitly *supposed* by the speaker, hearers need do no further work. The same kind

of explanation accounts for the conjunction case (34), except that instead of *supposing* the precondition, it is asserted.

Let's turn now to the disjunction case (36). Again, from our perspective, the question is this: Is there something about the filtering construction that makes it reasonable for a speaker to raise the possibility of Jane having stopped smoking without assuming that Jane has previously smoked? To evaluate this, it will be helpful to bear in mind the following, drawn from a variety of sources (Grice 1978, Roberts 1989, Simons 1998, 2001b, Zimmerman 2000, Geurts 2005, Singh 2008):

- i. Saying *A or B* typically implies that the speaker is not certain of the truth of either *A* or *B*.
- ii. A felicitous utterance of *A or B* requires that each disjunct can be construed as a partial answer to the same question.
- iii. The answers provided by *A* and *B* must be distinct partial answers.

Consider the consequences of this set of observations for presupposition projection in (36). In the first disjunct, the speaker explicitly entertains the possibility that Jane never smoked, which would normally exclude the possibility of simultaneously entertaining the possibility that Jane has *stopped* smoking. But this is in a disjunct, so the hearer expects the following disjunct to present a distinct possibility (condition (iii)) – but a possibility still relevant to whatever question is potentially addressed by the supposition that Jane never smoked (condition (ii)). So now felicity requires that the second disjunct must characterize a possibility that is disjoint from Jane never having smoked, but one that contextually entails a distinct partial answer to the same question. The content of the sentence itself thus makes it pragmatically *implausible* that the speaker is assuming a (global) context in which the precondition of *stop smoking* holds, since that would violate speaker uncertainty (condition (i)) about the truth of the first disjunct; thus, the first disjunct creates a context in which it is reasonable for the speaker to consider whether Jane has stopped smoking without assuming that she has previously been a smoker. If we take the QUD addressed by (36) as a whole to be ‘Does Jane smoke?’, then both disjuncts entail a negative answer but on different grounds—these are distinct partial answers. If we take the QUD instead to be ‘Has Jane ever smoked?’, then the two disjuncts entail distinct complete answers: ‘no’ vs. ‘yes’. With either QUD, both disjuncts are relevant, and the relevance of the second

disjunct does not require that the precondition of *stop* be globally assumed, but merely locally entailed.

The account of filtering that we have just given parallels the account given in section 3.2.1 of presupposition suppression. For both, the driving consideration is the listener's expectation that the speaker's contribution will be pragmatically reasonable. But the two cases differ in the following way: Presupposition suppression (for example, due to evident ignorance of the speaker regarding the relevant precondition) requires the listener to construct a good reason for the speaker to have raised the question of whether *p* in the absence of the presumption that the preconditions of *p* are true. The speaker who says of an evident stranger *Perhaps she recently stopped smoking* needs the listener to recognize the motivation for suggesting this possibility in the absence of the presumption that the stranger used to smoke. In contrast, in cases of filtering, the relevant precondition is explicitly asserted (in conjunctions) or supposed (in the case of conditionals), or else, in the disjunctive case, what is expressed in the "filtering" disjunct ensures the relevance of the non-projective reading in the potentially projective disjunct.

In some recent experimental work, Kalomoiros and Schwarz (to appear) observe that presuppositional conditional antecedents in evident ignorance contexts generate lower acceptability ratings than conditional sentences with either conjunctive or disjunctive filtering conditions in the antecedent.<sup>22</sup> This in fact is predicted by our proposal. For example, compare the pair of stimuli from their experiments in (37):

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

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<sup>22</sup> The experiments reported in the manuscript are designed to explore the symmetry question regarding filtering in disjunction. Examples like (36) above were used to provide a baseline for comparison. We're grateful to Florian Schwarz for pointing out that their data bear on our discussion of suppression vs. filtering.

- (a) If Cynthia either has stopped raising bees or has never raised any bees, then it makes sense that she hasn't heard about this. (Disjunctive antecedent in evident ignorance context)
- (b) If Cynthia has stopped raising bees, then it makes sense that she hasn't heard about this. (Simple presuppositional antecedent in evident ignorance context)

Our prediction regarding stimulus (37a) is that the use of *stop* is unproblematic. The hearer (or experimental participant) cannot attribute to the speaker the presumption that Cynthia used to raise bees because the speaker asserts ignorance about this question in the context. Additionally, the hearer cannot take the speaker to be presuming this even in the context relative to which the consequent is to be evaluated, because the disjunction in the antecedent indicates that the intended context for evaluation of the consequent does not resolve the question of whether or not Cynthia used to raise bees. In effect, the uncertainty that is asserted in the global context is carried through in the antecedent of the conditional: Both disjuncts describe situations in which Cynthia does not now raise bees. So the overall effect of the conditional is to say that Cynthia not currently being a bee-raiser would explain her lack of knowledge about current developments in the bee-raising world. The reason for the speaker to raise the possibility that Cynthia has *stopped* raising bees is the need to (as it were) cover all the bases, given their ignorance as to whether or not Cynthia has raised bees in the past; this is felicitous here because if one rejects the second disjunct as answer to the question of whether Cynthia has ever raised bees, this entails the precondition of *stop*, making the first answer felicitous. So this combination of context and utterance (a) indicates to the listener that the speaker does not assume that Cynthia used to raise bees, and (b) provides motivation for the interpreter to locally assume, in interpreting the first disjunct, that Cynthia has *done so* and now stopped.

Stimulus (37b) illustrates the very different case of attempted suppression in an evident ignorance context. As in (4a), the context indicates that the speaker does not assume that Cynthia used to raise bees, and the QUD is presumably “why hasn't Cynthia heard about the genetically modified bees?” There's also an apparent background assumption that if Cynthia raised bees, she'd be in touch with recent developments in apiary husbandry. (37b) is odd because *any* circumstance in which Cynthia currently doesn't raise bees—whether she once did but has stopped or never did—would be one which would explain her lack of current information. Then

why would the speaker specifically suppose only the first sub-case as an explanation? This would only make sense if either the speaker assumes that Cynthia once did raise bees—leading to a conflict with the explicit global ignorance – or the speaker assumes that (for some strange reason) only the once-did-then-stopped case, and not the never-did case would explain Cynthia’s lack of current knowledge. Since the last is very implausible, or at least doesn’t lead to an explanation in the context as given, it is as unacceptable as the global projection.

The explanation just given predicts that filtering in disjunction will be symmetric, at least in the antecedent of a conditional, as the explanation relies only on what assumptions can be attributed to the speaker given the contents of the disjuncts. This brings us into contact with an extensive theoretical and empirical literature on the question of filtering in disjunction. The idea that filtering in disjunction is in fact symmetric (contra early claims by Karttunen 1973 and Heim 1983) is gaining traction;<sup>23</sup> see Gazdar (1979), Karttunen & Peters (1979) and Soames (1979), Rothschild (2008), Chemla & Schlenker (2012), Sharvit (2023), Kalomoiros and Schwarz (to appear). The standard theoretical response to symmetry is to posit that each disjunct filters the presuppositions of the other. But this solution is not universally adopted; Hirsch & Hackl (2014) explore an account wherein disjunctive filtering—like that of conjunctions<sup>24</sup> and conditionals—is basically asymmetric, arising from incremental left-to-right calculation of local contexts for disjuncts, but is supplemented by a pragmatic mechanism triggered by the felicity conditions on disjunction, which mimics the effect of right-to-left filtering to avoid infelicity. Our account of filtering of preconditions remains neutral as to the local contexts for disjuncts.

The evidence in support of symmetric filtering in disjunction draws on multiple types of presupposition trigger. The Kalomoiros and Schwarz data, for example, include the trigger *stop* (a CoS predicate), *continue* (as discussed above, different from *stop* in a number of ways), and *again*. Other evidence for symmetry comes from anaphora data. Specifically, some speakers find both versions of Partee’s famous sentences in (38) (p.c. to Heim 1982) acceptable:

- (38) (a) Either there’s no bathroom in this house, or it’s in a funny place.  
(b) Either it’s in a funny place or there’s no bathroom in this house.

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<sup>23</sup> Though see Singh (2008).

<sup>24</sup> See Mandelkern et al. (2020) who provide convincing experimental evidence for the asymmetry of filtering in conjunctions.

But here too, not all theorists have taken the surface similarity as evidence of symmetric update. Roberts (1989) argues that the key to anaphora resolution in (38a) is that the question both disjuncts address is whether there's a bathroom in the house. The first disjunct is a negative existence claim, and its natural alternative is its negation, entailing that there's a bathroom in the house. This pragmatically entailed existence implication is part of the local context for interpretation of the second disjunct, yielding the weak familiarity of a bathroom in the house, which in turn licenses resolution of *it* in the second disjunct (Roberts 2003). Since—due to the underlying QUD—the implication still arises with the order changed in (38b), the entailed weak familiarity “saves the day” cataphorically in that version. This anaphora resolution is not due to straightforward dynamic, incremental local context update, but is a complex function of the QUD and pragmatic reasoning. This is an earlier instance of the Hirsch and Hackl position that apparent symmetry does not necessarily reflect symmetry in context update.

And indeed other anaphoric cases fail symmetry. Consider the novel example below:

(39) [Context: A colleague addresses the department secretary, outside the Chair's office:]

Colleague: Can I pop in to have a word with Jones this morning?

Secretary: Sorry Sarah.

- (a) Either Jones is in a meeting with a new student, or else the student is waiting in the lab.
- (b) Either the student is waiting in the lab, or else Jones is in a meeting with a new student.

But I think he has time this afternoon.

In the felicitous (39a), *the student* is understood to refer to the new student mentioned in the previous disjunct. But (39b) is infelicitous unless the context provides an already salient student who can serve as antecedent for the definite *the student*. The anaphora cannot get resolved cataphorically from the second disjunct.

Space prevents further exploration of this topic. We raise it to make the following point: we have argued throughout that projection and filtering of –SCF projective contents cannot be explained using the standard Karttunen/Heim mechanisms. Those mechanisms explain the behavior of contextual constraints; but –SCF projective contents do not impose contextual

constraints. The perfect alignment of patterns of projection of +SCG and –SCF projective contents poses a challenge to that claim, which we have tried to meet by arguing that projection patterns in both cases are sensitive to incremental context update, although in different ways. However, if the observations about (39) are robust, disjunction may turn out to be a case that pulls apart anaphoric and non-anaphoric projection. We leave further exploration of this question to later work.

In all of the filtering constructions considered above, the addressee does not assume that the speaker assumes the precondition  $q$ —i.e. that the speaker is committed to the truth of  $q$ —because the speaker has explicitly either asserted (34), supposed (35), or non-assertively entertained (36) that  $q$ , in turn implicating that they did not assume  $q$  beforehand. Thus, we explain filtering of preconditions pragmatically as a function of context update plus the semantics and pragmatics of the filtering constructions. And because the same dynamic context update is central as well to the way that anaphora may be resolved utterance-internally, the account predicts parallel filtering patterns in the two kinds of projective content, at least for conjunctions and conditionals, satisfying the third desideratum noted in the introduction: addressing the filtering problem. In the case of filtering in disjunction, the classical account predicts that anaphoric presuppositions are filtered asymmetrically, an account that has in recent work been taken to be inconsistent with empirical findings. But the account given here for –SCF contents straightforwardly predicts the possibility of symmetric filtering for non-anaphoric presuppositions without necessarily taking context update to be symmetric in disjunction—leaving open an explanation of anaphoric cases like (39).

## 5 Conclusions and open questions

We have argued for an integrated approach to the triggering problem and the projection problem for the projective content of a large class of non-anaphoric triggers: the CoS verbs, factives, and selectional restrictions. For each of these, its projective content consists of those entailments of its semantic content which are ontological preconditions of the associated event-type. While we've discussed selection restrictions only briefly, we consider it an important consequence of our approach that we are able to handle these. While as noted these projective contents have not been heavily discussed, their projectivity means that almost every predicate turns out to have projective content. We explained the projectivity of preconditions by appealing

to informativity: In most contexts, a speaker who denies or raises the possibility that E occurred but who does not assume the preconditions of E to be met will be saying something quite uninformative; a speaker who asks whether E occurred without assuming its preconditions will similarly be asking a low-utility question. Assuming preconditions to hold is a default strategy for ensuring the informativity of utterances. Hence, use of the triggers under consideration is a strong but defeasible cue for the construction of a projective interpretation. Thus, unless the result would be pragmatically implausible, preconditions will strongly tend to project.

On our view, filtering contexts are those in which, given a Heim-style understanding of local context update, the trigger occurs in a local context in which it is typically less plausible to take the speaker to presume the truth of its projective content. So our account also provides a natural resolution of the filtering problem, while being consistent with empirical evidence that filtering is slightly different for anaphoric and non-anaphoric projective content.

The resulting approach is simple and explanatory, and we have argued throughout that it holds several advantages over a classical approach in which the non-anaphoric triggers in question are treated as imposing a strong contextual felicity condition on the context of interpretation. Here is one more advantage: Unlike the Karttunen/Heim/van der Sandt approach, this approach does not predict what Geurts (1996) called the *proviso problem*, wherein filtering predicts odd, unattested presuppositions: E.g., *If John likes coffee, his wife is happy* is predicted to presuppose ‘if John likes coffee, John has a wife’. On the present approach, there is no proviso problem because there is no local accommodation. Recent experimental work by Silk (2022) argues that ours is the correct prediction. The proviso problem is an artifact of a misconception about projection and filtering.

Finally, though there is not space to explore this here, the pragmatic approach proposed is clearly consistent with the attested variation in projectivity across predicates and predicate types, explored experimentally and in corpus work by many authors over the past few years, as extensively cited above. As the exploration of differential suppressibility in 3.2.2 suggested, whether projective content does or does not project in a given context is a function of a complex set of factors, some lexical, others contextual. The classical approach takes projection to be algorithmically predicted on the basis of the presence of the lexical trigger and the way that local context is determined dynamically. Particular features of the trigger’s semantic content and the

context of utterance do not play a central role. In contrast, we assume that rich details about the contexts of utterance, as well as the specific linguistic choices made by the speaker, all contribute information that the listener integrates in assigning interpretations. In our view, the fact that the predictions of our proposal are sensitive to multiple and various contextual/lexical features is a feature, not a bug.

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