No hard feelings if hard presuppositions project*

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Abstract While emotive predicates like *be happy* are mostly taken to be factive presupposition triggers, their acceptability in mistaken-belief scenarios challenges this assumption. In an experiment, we find that emotive predicates pattern with hard triggers when it comes to presupposition projection and contrast with semi-factives and non-factives. At the same time, we confirm their acceptability in mistaken-belief contexts. We argue that emotive predicates semantically come only with belief-relative presuppositions, which may optionally be supplemented pragmatically with an additional inference that behaves like the classical factive presupposition. This investigation sheds new light on how presuppositions should be understood.

Keywords: presuppositions, projection, factivity, soft and hard triggers, local accommodation, experiment

1 Introduction

Presuppositions are commonly understood as admittance conditions that sentences place on contexts. If a sentence with a presupposition is uttered in a context that does not satisfy its presupposition, speakers detect, in the absence of repair mechanisms, some amount of infelicity or oddity, described as a presupposition failure. Very often, however, this is taken to indicate that the presupposition of a sentence is the unifying feature of the contexts that speakers tend to *accommodate* to accept an utterance as felicitous.

Here is an example involving emotive predicates.[1] Speakers most naturally picture a context for (1a) where it is indeed the case that Aditi bought a car. For (1b), however, we can easily picture a context of utterance where the matter of Aditi's car purchase is not settled or even false without an effect on felicity. Since (1a) and (1b) differ minimally only in the matrix predicate, the conclusion generally advanced is

* We thank ...

1 Throughout the paper, we will use the expression *emotive predicates* to indicate predicates that have traditionally been called *emotive factives*. Examples of these predicates are *regret*, *be happy*, *be sad*, and *be angry* when followed by the complementizer *that*. We will ignore other attitude predicates with an emotive component that do not lead to the same factive inference, like *hope* or *fear*.

that the emotive predicate *regret*, but not *believe*, presupposes the truth of the embedded proposition: it triggers a factive presupposition. This inference is robust and clashes with a context that entails its negation, as shown in (2).

(1) a. Skye regrets that Aditi bought a car.
$\rightsquigarrow$ Aditi bought a car.

b. Skye believes that Aditi bought a car.
$\not\rightsquigarrow$ Aditi bought a car.

(2) #Aditi didn't buy a car, and/but Skye regrets that she did.

Partially against this view, we will argue that presuppositions are not directly available for introspection — a point that mirrors what Fox (2013) and Mandelkern & Rothschild (2018) say on the matter. Speakers do have intuitions about truth and felicity in a context, but as we will show, the inferences that speakers draw after hearing or reading a sentence should not be taken as unmediated evidence to decide what the presupposition of that sentence is. Rather, people draw inferences on the basis of accommodation strategies and pragmatic reasoning, which may or may not align with the semantic presupposition a given sentence comes with.

Emotive predicates are a case in point. If a predicate like *regret* presupposes the truth of its complement, the acceptability of (3) below is surprising (example from Egré 2008: p. 102, based on Schlenker 2005: fn. 12; cf. Klein 1975: B12 for the original observation). The acceptability of the sentence is at odds with the presupposition obtained by generalizing over the context accommodated for (1a): in (3), a factive presupposition triggered by *regret* should conflict with the assertion of the first conjunct. On the assumption that presupposition failure causes infelicity, the contradiction between the factive presupposition and the assertion should lead to degradedness, but (3) is perfectly acceptable.[2]

(3) John wrongly believes that Mary got married, and he regrets that she is no longer single.
$\not\rightsquigarrow$ Mary is no longer single.

The existence of a non-embedded context where a trigger with an alleged presupposition is acceptable despite a direct contradiction of that presupposition should give one pause. On its face, the puzzle we describe here is a classical one where certain contextual configurations appear to remove an expected inference: emotive predicates like *regret* are commonly understood as lexically giving rise to a factivity inference, which however seems to disappear in our mistaken-belief scenario.

2 Some few speakers reported to us that sentences like (3) are somewhat marked, but as we will show, we were not able to corroborate this intuition experimentally.

Analyses for these types of problems are often cast in terms of how this removal is achieved as a function of the context.

Indeed, there are analyses on the market that go about a solution in just this way. For example, Abrusán (2022) relies on contextual shifts that achieve a weakening of the factive inference, and she avoids presupposition failure by relativizing factivity to only one of the involved belief states (see. Section 3.2). Yet another analysis of the weakening type could be one where presupposition failure is averted by means of suspending factivity.

Others, like Karttunen (2016), have questioned the very nature of the factive inference for emotive predicates and have asked whether what we typically describe as a presupposition is better analyzed as some other meaning component. If factivity for these predicates came about via an implicature, what mistaken beliefs show is no longer a weakening of an inference, but merely a context under whose influence the factivity implicature does not arise in the first place.

Against this backdrop, the question of how to analyze emotive predicates' meanings in contexts featuring mistaken beliefs starts with a classification problem for the factive inference more generally. Before presenting different possible analyses, we will aim at clarifying the empirical facts for predicates like *regret* in relation to other factive and non-factive predicates. Given that the standard analysis for emotive predicates places them among the presupposition triggers, we take this as the starting point of our investigation. By comparing emotive predicates with less controversial presupposition triggers, we will be able to see whether the presuppositional starting point of analyses like Abrusán's is warranted or whether factivity inferences display patterns that motivate a non-presuppositional approach like that of Karttunen. Only with this first question settled is it possible to turn to the analysis of the puzzle itself.

Instead of relying on introspective judgments, we will adopt an experimental approach. In our experiment, we will see evidence that treating emotive predicates as presupposition triggers is indeed warranted. Taking this seriously, we will attempt to resolve the puzzle by relying on a possible divergence between what speakers accommodate and what a trigger presupposes. The solution to the mistaken-belief puzzle that we will be advocating for follows an idea already put forth by Egré (2008), and we will assume the same semantic presupposition for *regret* both in (1a) and (3), suggesting that differences in accommodation derive the factivity intuition in (1a) but not in (3).

Before presenting the experiment that we designed for this purpose, we will give a brief overview of the relevant background, spanning the heterogeneity of presupposition triggers and the different kinds of projection profiles these triggers are standardly taken to allow for. Especially the issue of projection is an important

one given what we said about a potential analysis that places suspension at its center, as will hopefully become clearer shortly.

In the remainder of this paper, we will take a closer look at the problematic cases listed above and attempt a reconciliation with a presuppositional analysis for emotive predicates. We will argue that what mistaken-belief examples show is not an unstable presupposition or an implicature, but rather a tendency in the contexts that speakers choose to accommodate. Ultimately, we will conclude that these predicates are presuppositional, but that their presupposition is about the beliefs of the attitude holder, not the truth of the proposition denoted by the embedded clause. Nonetheless, these predicates give rise to a factive inference in most contexts, and we will spend some time providing an account of how this inference might be derived.

So far, we have observed that the factive inference seems to be absent in contexts of mistaken beliefs. Therefore, we first want to establish whether outside of mistaken-belief contexts, the factive inference indeed behaves like a presupposition. A refinement of this question immediately arises: if it behaves like a presupposition, is the nature of this inference that of a hard or a soft presupposition? It is known in the literature (Abusch 2002, 2010, Abrusán 2011, Romoli 2012, Chen, Thalmann & Antomo 2022) that certain presuppositions, called *soft*, are relatively weak and context-dependent, and they can be suspended (or locally accommodated) in certain environments.

Our hypothesis is that the factive inference of emotive predicates does not behave like a soft presupposition, but rather like a *hard* one. The main diagnostic that exposes a difference between soft and hard presupposition triggers embeds them in the antecedent of a conditional: those that are deemed acceptable when the speaker asserts that they are ignorant as to the truth value of the presupposition are soft triggers. Instead, those that lead to infelicity in the same context are hard triggers (Abusch 2002, 2010).[3] Consider the contrast in (4).

(4) a. I don't know whether the duck was ill, but if the panda realizes that she was, he will be worried.

b. #I don't know whether anybody was ill, but if the duck was ill too, the panda will be worried.

Assuming that *realize* and *too* are both presupposition triggers — the first presupposing that the duck was ill, the second presupposing that someone other than

3 This difference is often cashed out in terms of local accommodation, an operation that effectively allows for treating presupposition failure as falsity (Heim 1983, Beaver & Krahmer 2001), and which is assumed to be available for soft presuppositions but not for hard ones. For our purposes, the mechanism to derive the contrast in (4) is not essential; only the diagnostic itself is.

the duck was ill, — our diagnostic reveals that *realize* triggers a soft presupposition, whereas *too* triggers a hard one. Verbs of discovery have been known since at least Kiparsky & Kiparsky (1970) to trigger presuppositions that are less stable than other presuppositions, and explicit ignorance contexts like the ones above bring this instability to the fore. Following Abbott (2006) and Abrusán (2016), we may classify such *semi-factives* as soft presupposition triggers. Assessing the behavior of emotive predicates in this same context will be one of the goals of the experiment presented in Section 2.

Here, we would like to justify our hypothesis that emotive predicates are hard presupposition triggers based on an independent observation. The experimental data in Chen, Thalmann & Antomo 2022 suggest that soft presuppositions are unlike hard ones in their ability to be *at-issue* and answer questions. According to our judgments, the factive inference associated with emotive predicates, unlike the factive presupposition of verbs of discovery, cannot directly answer a question. This is shown in the contrast in (6). Note that, while (6a) was included in the experimental items and judged as acceptable in Chen, Thalmann & Antomo (2022), (6b) was not, and the judgment reflects our intuitions[4]

(6) a. A: Where is the bouncy ball?
B: The panda found out that the bouncy ball is under the table.
b. A: Where is the bouncy ball?
B: #The panda regrets that the bouncy ball is under the table.

In this paper, we will assume a dichotomy between soft and hard presupposition triggers. However, we will not commit ourselves to what the source of this distinction might be, nor will we present evidence in favor of assuming exactly two levels of presupposition hardness. In connection with this issue, Tonhauser, Beaver & Degen (2018) have proposed that presupposition hardness is a gradient phenomenon. The viability of this proposal is essentially orthogonal to our discussion: as long as emotive predicates trigger presuppositions harder than semi-factives and not softer than other prototypical hard triggers, it is unlikely that the acceptability of (3) should be reduced to an effect of presupposition suspension.

4 A possible concern is that independent factors might undermine the ability of a predicate to embed an answer to the question, like the preferential component of emotive predicates (Clemens Mayr, p.c.; see also Uegaki & Sudo 2019). According to our intuitions, a preferential component does not itself determine the not-at-issueness of a complement clause, as shown by the case in (5). Of course, the predicates in (5) do not presuppose or entail a direct answer to the question, so a minimal pair with the examples in (6) is not possible.

(5) A: Where is the bouncy ball?
B: I'm hopeful/worried that it's under the table.

The paper is structured as follows: Section 2 presents the design and results of an experiment testing multiple empirical issues. We will find that emotive predicates indeed pattern together with hard triggers outside of scenarios that involve misalignment between the speaker's and the attitude holder's beliefs. In Section 3, we attempt a synthesis of the presuppositional nature of emotive predicates and the puzzle posed by the mistaken-belief examples. Further, we address whether the analyses by Karttunen (2016) and Abrusán (2022) meet the empirical and theoretical desiderata. Section 4 concludes.

2 Experiment

In order to figure out whether outside of mistaken belief contexts, emotive predicates behave like factive presupposition triggers, we carried out an experiment where we manipulated the linguistic context and tested for discourse coherence.

Since the status of the factive inference of emotive predicates is controversial, we will compare them with other types of presupposition triggers. If emotive predicates are not presupposition triggers after all, we should not find strong differences between them and other non-presuppositional attitude predicates, like *believe*. If what was called a factive presupposition of emotive predicates are instead only an entailment or a soft presupposition, emotive predicates should behave like semi-factive attitude predicates like *realize*. In addition, we should find that uncontroversially hard triggers, like the additive particle *too*, should pattern differently from emotive predicates.

If on the other hand, mistaken-belief scenarios are not a test for the stability of the factive presupposition of emotive predicates, which are instead hard presupposition triggers per our hypothesis, we should find that emotive predicates pattern differently from non-factives and semi-factives, and possibly in a way that resembles hard triggers like additive particles in terms of presupposition projection.

2.1 Design

We carried out an Acceptability Judgment Task in Italian to probe into the effects of presupposition violations with a variety of triggers. The task, implemented with PCIbex (Zehr & Schwarz 2022), is accessible here: https://farm.pcibex.net/r/WWrlKZ/.

The experiment was structured as the combination of two sub-experiments, but the order in which the items were presented did not reflect this division (more about this below). Both sub-experiments feature a CONTEXT manipulation and a TRIGGER. The context was manipulated within-items and within-participants. The trigger manipulation was between-items and within-participants: given the different

meaning contribution and syntactic distribution of the different presupposition triggers chosen for the experiment, it was not possible to manipulate the triggers within item without increasing the complexity beyond what is practical. Upon reading the items, participants were asked to judge them using a Likert scale from 1 to 7 to indicate how these sentences scored between *not acceptable at all* (1) and *completely acceptable* (7).

The first sub-experiment compared emotive predicates (*be angry*, *be sad*), semi-factive verbs of discovery (*understand*, *realize*), and non-presuppositional doxastic verbs (*think*, *believe*), as well as two prototypical hard presupposition triggers as a control, namely the additive particles *too* and *again*. To test for their projective behavior out of conditional antecedents, the sentences containing these triggers were placed in two types of contexts. The first type is a context of explicit ignorance (called $\neg Kp$ *if*), which reproduces the test in (4), repeated below. If they trigger hard presuppositions, we expect emotive predicates to pattern differently from the doxastic controls and the soft presupposition triggers in this condition, neither of which should be deviant.

(4) a. I don't know whether the duck was ill, but if the panda realizes that she was, he will be worried.

b. #I don't know whether anybody was ill, but if the duck was ill too, the panda will be worried.

The second type of context is the $\neg p$ *if* condition. Here, instead of an ignorance statement, the proposition denoted by the attitude complement (or the proposition presupposed by the additive particle) is explicitly denied before the conditional is encountered. This serves as a negative control in which only the non-presuppositional doxastic predicates are acceptable, while all (soft and hard) presupposition triggers should lead to low acceptability ratings. It is generally assumed that indicative conditionals require their antecedent to be possibly true in the context, a requirement that is not satisfied in our $\neg p$ *if* manipulation, as shown in (7).

(7) #The duck was not ill, but if the panda realizes that she was, he will be worried.

The design of the first sub-experiment is summarized in (8).

(8) Sub-experiment 1 4×2 Design, 32 items

a. TRIGGER (Additive vs. Emotive vs. Semi-factive vs. Non-factive)

b. CONTEXT ($\neg Kp$ *if* vs. $\neg p$ *if*)

The second sub-experiment tests the effect of a mistaken belief context for emotive predicates (*be angry*, *be sad*) and semi-factives (*understand*, *realize*) along the

lines of the example in (3): we call this condition *mistaken belief*. The second level of CONTEXT serves as a negative control (called $\neg p$ *and*): just like in a context of mistaken belief, the truth of the embedded proposition is denied, but no mistaken belief is explicitly ascribed to a character.

In the second sub-experiment, no item has the syntax of a conditional. Although we also include semi-factives here and thus test for their acceptability in mistaken-belief scenarios, this should be considered an exploratory portion of the experiment. As will become evident in Section 2.2 with the materials, given the different event structures between emotive predicates and verbs of discovery, it was not possible to compare these two types of predicates in identical constructions.

(9) Sub-experiment 2 — 2×2 Design, 16 items

a. TRIGGER (Emotive vs. Semi-factives)

b. CONTEXT (mistaken belief vs. $\neg p$ *and*)

The items from the two sub-experiments were presented in a single experimental session. For this experiment, 40 participants (mean age 21.3 ± 3.3; 36 identifying as female) were tested.

2.2 Critical items

We will first briefly comment on our choice of Italian as the language of our experiment. We do not expect our results to be language-specific in any theoretically interesting way, and we therefore take them to be potentially informative for our general understanding of presuppositions. The literature on presupposition projection generally assumes that similar lexical items across languages behave the same with respect to the projection of the presuppostion they trigger.

The main reason for choosing to run this experiment in Italian (over, say, English) is that Italian is a subject-drop language with clitics. Given that in our items for sub-experiment 1, the subject of the clause embedded under the factive predicate is always dropped and the object is always a clitic, this clause always needs to be read with the same prosody: the embedded verb is the only overt element that can be stressed. The subject, being null, and the object, being a clitic, can never be stressed. See Beaver (2010) for a discussion about how prosody can affect presupposition projection.

In Italian, emotive predicates and belief reports, but not verbs of discovery, require dedicated verbal morphology in the embedded clause. This is traditionally called "subjunctive mood," but it is unrelated to counterfactual constructions. Although mood alternation creates a difference between how certain conditions are spelled out, this difference is entirely determined by the choice of the embedder,

Figure 1 Image shown in the introduction.

which is our experimental manipulation. We do not expect this difference to be informative semantically, as it might be in certain cases in Spanish (see Villalta 2008), given that a different choice of mood in our items simply leads to ungrammaticality.

At the start of the experiment, a narrator was introduced in a fictional story with three animal protagonists: the duck, the panda, and the frog. These animals were represented as in Figure 1.

Below, we list a translated example item for each condition of the first subexperiment; for each pair of sentences, (a) is the $\neg Kp$ *if* context, and (b) is $\neg p$ *if*. Original items in Italian are included in Section A.

(10) **Non-factives** *think, believe*

a. I don't know if the duck got the top grade, but if the frog thinks that she did, she will be jealous.

b. The duck didn't get the top grade, but if the frog thinks that she did, she will be jealous.

Since no presupposition trigger is present, items like (10) are predicted to be acceptable in both manipulations of the context. Instead, the predictions differ for items (11) to (13) according to the strength of the presupposition trigger.

(11) **Additive particles** *too, again*

a. I don't know whether the panda stole anything from the frog, but if he stole her hat too, the frog will rip his bathing suit.

b. The panda didn't steal anything from the frog, but if he stole her hat too, the frog will rip his bathing suit.

(12) **Emotive predicates** *be angry, be sad*

a. I don't know whether the duck lost the kite, but if the panda is angry that she did, he will hurl her sunglasses in the sea.

b. The duck didn't lose the kite, but if the panda is angry that she did, he will hurl her sunglasses in the sea.

(13) **Semi-factives** *understand, realize*

a. I don't know whether the frog manipulated the card deck, but if the panda understands that she did, he will uninvite her from the next sleepover.
b. The frog didn't manipulate the card deck, but if the panda understands that she did, he will uninvite her from the next sleepover.

In (14) and (15) below, we give example items from the second sub-experiment. As with the first sub-experiment, original items in Italian are again included in Section A. The (b) sentences, in the $\neg p$ *and* context, are predicted to behave like true cases of presupposition failure, while the (a) sentences, in the *mistaken belief* context, try to recreate the conditions of sentences like (3) from the literature at least for emotive predicates, which are considered acceptable in mistaken belief contexts.

With emotive predicates, the context introduces a statement containing the expression *mistakenly believes*. Instead, in the exploratory portion of the experiment with semi-factives, our manipulation directly modifies the predicate with the adverb *mistakenly* after a context contradicting the factive presupposition. The reason for this choice is related to the event structure of the verbs of discovery used for this experiment, which denote a change of belief state in the attitude holder. By directly modifying the semi-factive predicate with the adverb, we indicate that the mistaken belief state is the one that follows the change of state denoted by the predicate, not the one that precedes it — which would be trivial.

(14) **Emotive predicates** *be angry, be sad*

a. The duck mistakenly believes that the panda made the roses die, and she's angry that he made them die.
b. The panda didn't make the roses die, but the duck is angry that he made them die.

(15) **Semi-factives** *understand, realize*

a. The frog did not break the toy cars, but the panda, after examining them, realized that the frog broke them.
b. The frog did not break the toy cars, but the panda, after examining them, mistakenly realized that the frog broke them.

After a short warm-up phase that was designed to allow the participants to familiarize with the experimental task, the items (both the critical items exemplified above and the unrelated fillers) were presented in randomized order with just one restriction: no condition containing the word *mistakenly* was seen by any participant before all other items with an emotive or a semi-factive predicate had been presented. This was done to prevent the participants from concluding that the characters are expected to have false beliefs, which might affect the judgments even

when no context of mistaken belief is made explicit. Organized this way, the option of having false beliefs is presented only when all items that could potentially be affected have already been seen, and the participants were not encouraged to accommodate mistaken belief contexts before these are introduced by the experimental manipulation.

2.3 Predictions

Being non-presuppositional, we expect items with non-factive predicates to receive high ratings in both conditions of sub-experiment 1. In contrast to these controls, we assume that emotive predicates pattern with genuine presupposition triggers like additive particles when it comes to presupposition violations: both the $\neg Kp$ *if* and the $\neg p$ *if* conditions should lead to noticeable degradedness.

In the $\neg Kp$ *if* condition, semi-factive predicates should elicit better judgments because either, on our view, local accommodation applies, or the veridical entailment is canceled, as argued by Karttunen (2016). Since local accommodation is often viewed as a repair strategy (Chemla & Bott 2013, Romoli & Schwarz 2015, but see Göbel & Schwarz 2023), one might hypothesize that speakers will penalize that condition slightly, but whether this is indeed the case would have to be independently established. In the $\neg p$ *if* condition, semi-factives should instead be unacceptable. As explained above, this manipulation creates a context in which the antecedent of the conditional cannot be true. Local accommodation cannot rescue the item, on the assumption that it makes the presupposition part of the entailed content.

As for sub-experiment 2, we expect the *mistaken belief* manipulation — at least for emotive predicates — to make the items acceptable, following the intuition in the literature. In contrast, the $\neg p$ *and* condition should be strongly penalized because the first conjunct conflicts with the factive inference in the absence of a mistaken belief context. As we mentioned above, the inclusion of semi-factives in mistaken-belief contexts is purely exploratory, and the manipulation between the two kinds of predicates is not minimal. For this reason, we assume the null hypothesis of no difference between the two trigger types in this condition without commitment.

Figure 2 summarizes our hypotheses. We here additionally include a contrast between $\neg Kp$ *if* and $\neg p$ *if* for hard presupposition triggers because it was found in a pilot, which however did not test the additive particles *too* and *again*.

2.4 Statistical analysis

We fit two Bayesian cumulative probit mixed models, one for each sub-experiment, in R (4.3.2; Team 2023) using *brms* (Bürkner 2021). The model was specified for

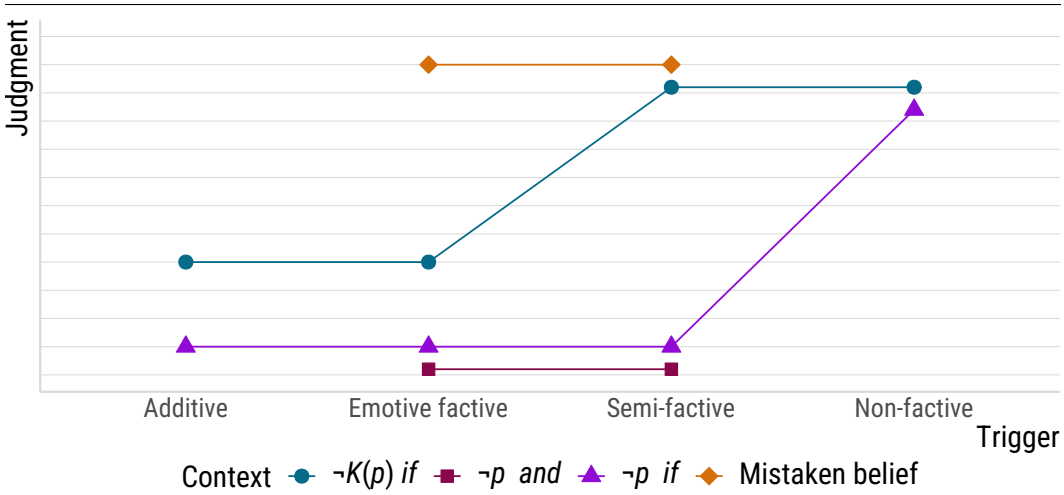

Figure 2 Plot of the hypothesized patterns in both sub-experiments.

40.000 samples, half of which were part of the warm-up samples. Since the cumulative model includes parameters for the thresholds between the different members of the Likert scale, we supplied priors for these parameters as well, following the procedure outlined by A. Solomon Kurz.[5]

The model included parameters for both the TRIGGER and CONTEXT factors, as well as their interaction. For these, we supplied $N(0,1)$ slope priors, all other priors were default priors. In addition, the model included the maximum random effect structure appropriate for the mixed design employed here.[6]

For assessing differences between conditions, we relied on highest density intervals (HDIs) associated with posterior conditional effects and Bayes' factors. The posterior conditional effects and their HDIs were obtained using the *brms* function `conditional_effects`. The Bayes' factors were computed using the `bayesfactor_parameters` function from *bayestestR* (Makowski, Ben-Shachar & Lüdecke 2019).

2.5 Results

The raw results are displayed in Figure 3. It is of note that the non-factives controls were rated as acceptable and generally contrasted with the items that featured presupposition triggers, which indicates that participants understood the task.

5 https://solomonkurz.netlify.app/blog/2021-12-29-notes-on-the-bayesian-cumulative-probit/

6 Formula: $Y \sim \text{TRIGGER} * \text{CONTEXT} + (1 + \text{CONTEXT} \mid \text{ITEM}) + (1 + \text{TRIGGER} * \text{CONTEXT} \mid \text{ID})$.

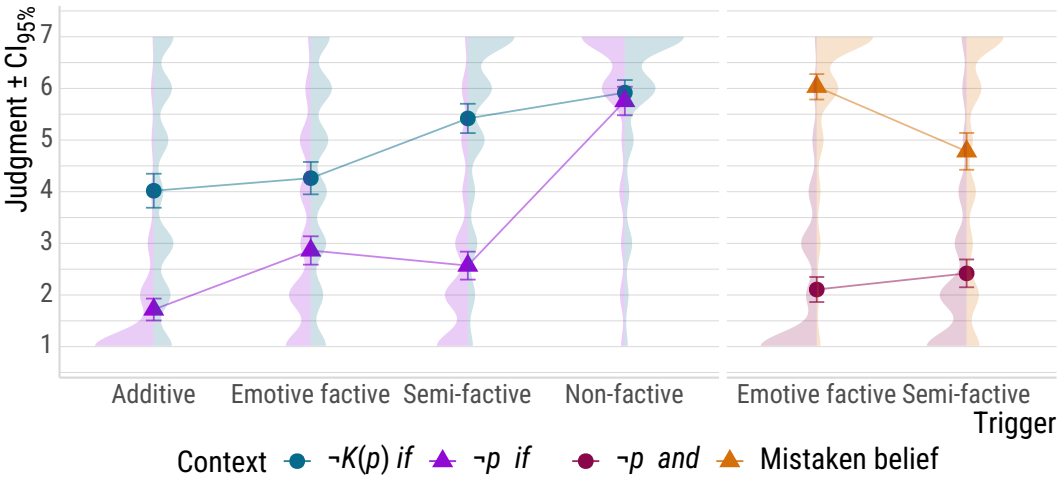

Figure 3 Raw results. The shaded areas indicate the raw rating distribution. *left:* sub-experiment 1, *right:* sub-experiment 2.

While normally, visual inspection of confidence intervals is an imprecise method of establishing whether differences between condition means are statistically reliable (and even more so in repeated measures context like here; see Cumming & Finch 2005, Masson & Loftus 2003), Bayesian HDIs do not come with this problem, and hence, we will rely on the posterior conditional effects shown in Figure 4 for part of the interpretation of the data. The estimates for the fixed factors of the models that these HDIs are based on can be found in Section B.

In sub-experiment 1, non-factives in the ¬*p if* condition are acceptable and differ from all other triggers. Since this condition explicitly negates the truth of the clause embedded under the attitude predicate, the difference suggests that speakers identified the contrast between non-presuppositional controls and presupposition triggers.

In the same ¬*p if* condition, additive particles, emotive predicates, and semi-factives all fall within the range of unacceptability, preferred ratings being 1 and 2 on the Likert scale (as can be seen from the shaded areas in Figure 3). Although additive particles are judged significantly worse than the other triggers in this group, this is likely due to a feature of our items. Consider (11b), repeated below: what the context negates is not just the presupposition of the additive particle, but also the assertive component, so to say, of the conditional antecedent. The antecedent *if he stole her hat too* is a proposition that presupposes that the panda stole something other than her hat from the duck, and that entails that he stole her hat. Both of these meaning components are contradicted by the context, which means that even if the

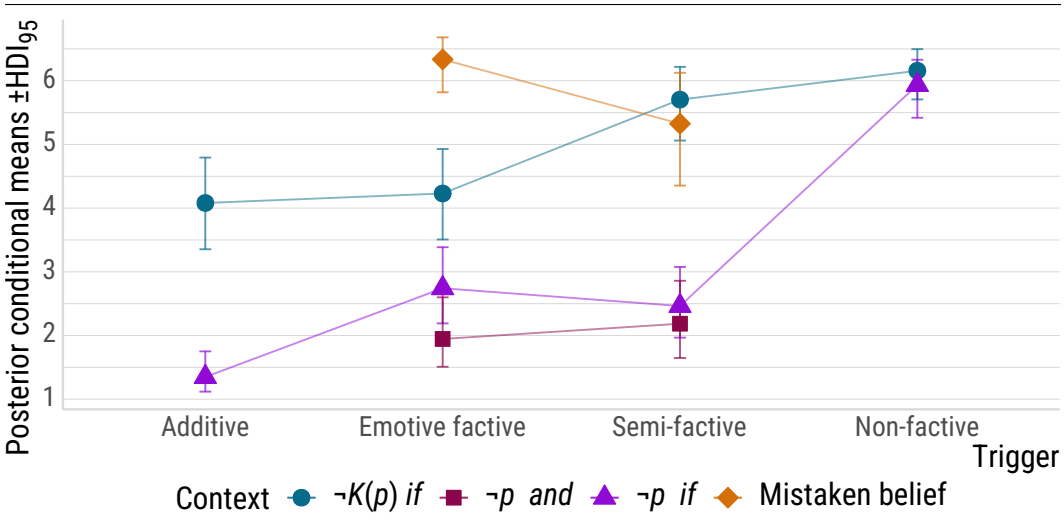

Figure 4 Posterior conditional effects.

item had not included the trigger *too*, we would have expected unacceptability. With this in mind, it is unsurprising that participants judged this condition more harshly with additives than other presupposition triggers, where no parallel issue occurs.

(11b) The panda didn't steal anything from the frog, but if he stole her hat too, the frog will rip his bathing suit.

In the ignorance condition, $\neg Kp$ *if*, we see that additive particles and emotive predicates pattern together and differ from both semi-factives and non-factives. In this condition, our four triggers can be grouped into two acceptability profiles: one where ignorance has no effect on acceptability (semi-factives and non-factives) and one where ignorance elicits judgment penalties (additive particles and emotive predicates). We additionally see that even for the latter group, an effect of the contextual manipulation makes the ratings better than in the $\neg p$ *if* condition.

In sub-experiment 2, we find that both emotive and semi-factive predicates are unacceptable in the $\neg p$ *and* condition. This is in contrast with their behavior in the *mistaken belief* condition, where they received much more favorable judgments. At least for the emotive predicates, which scored a bit higher than semi-factives, this confirms the overall acceptability of these predicates in mistaken belief contexts. The interpretation of the contrast between emotive and semi-factive predicates in the *mistaken belief* condition is not straightforward. We return to this below.

The Bayes' factors in Table 1 confirm the interpretation that we gave of Figure 4.

Comparison	$\log_{BF}$	Interpretation
$\neg Kp$ if: Semi-factive vs. Emotive	4.73	extreme evidence for difference
$\neg Kp$ if: Semi-factive vs. Additive	4.66	extreme evidence for difference
$\neg Kp$ if: Emotive vs. Additive	−1.52	moderate evidence for similarity
$\neg Kp$ if vs. $\neg p$ if: Emotive	4.20	very strong evidence for difference
$\neg p$ if: Semi-factive vs. Emotive	−1.66	moderate evidence for similarity
$\neg p$ if: Semi-factive vs. Additive	2.35	strong evidence for difference
$\neg p$ if: Emotive vs. Additive	2.79	strong evidence for difference
Mistaken belief: Emotive vs. Semi-Factive	2.15	moderate evidence for difference
$\neg p$ and: Emotive vs. Semi-Factive	−1.20	moderate evidence for similarity

Table 1 Bayes' factors. Positive values support difference hypotheses, negative ones support the null. Within conditions: Predicate differences.

2.6 General discussion

The foregoing experiment was designed to answer two questions: first, whether the factive inference of emotive predicates behaves as a presupposition, and if so, whether it is soft or hard. Second, we wanted to know the degree of acceptability of the same emotive predicates in mistaken-belief contexts.

As for the first question, we saw that emotive predicates behave like additive particles and unlike semi-factives or non-factives. Given that additive particles are considered prototypical hard triggers, our data are best explained if emotive predicates are hard presupposition triggers, too. When triggered in a conditional antecedent, the factive inference associated with them causes unacceptability if the context negates it, and intermediate acceptability when the speaker is ignorant about its truth value. A difference between these two categories was observed in the $\neg p$ *if* condition, but this difference is not a diagnostics for presupposition hardness. We gave an explanation for this contrast in Section 2.5 by discussing (11b).

Instead, semi-factive predicates score significantly higher on the scale in the $\neg Kp$ *if* condition, in a way that can be interpreted as full acceptability — just like in the case of the non-presuppositional *think* and *believe*. While the lack of a penalty in explicit ignorance contexts for semi-factives might be interpreted as evidence against local accommodation as a last resort or repair strategy, our experiment was not designed to test this hypothesis, so we mention this result only in passing.

It is important to notice that although we have been assuming that verbs of discovery like *understand* and *realize* are presuppositional, this is not a hypothesis our experiment could adjudicate. Our results for semi-factives are also compatible with other analyses, such that what we here call a soft presupposition might instead

be an entailment (Romoli 2015,[7] and perhaps Karttunen 2016: p. 713). Crucially, our conclusion about emotive predicates does not hinge on this choice: regardless of what the best analysis of semi-factives is, our experiment suggests that emotive predicates pattern differently and so merely motivates an analysis on which these differences are expected.

As mentioned above, we detected a contrast for emotive predicates between the $\neg Kp$ *if* and the $\neg p$ *if* conditions. Although we included this contrast in the hypothesis plot in Figure 2 because it was found in a pilot, it is not predicted by our standard understanding of presuppositions, according to which the items should just be unacceptable in both conditions. For the purpose of this paper, we note that the judgment of intermediate acceptability that emotive predicates receive in the $\neg Kp$ *if* condition cannot be the result of the participants accommodating a context of mistaken belief. If participants were able to accommodate such a context for these items, this same option would rescue the items in the $\neg p$ *if* condition, contrary to what we observe. Additionally, the same contrast is observed for additive particles, which suggests that it might be related to how participants generally deal with presupposition failures in our design, rather than a property of emotive predicates specifically. Given that at most speculation is possible at this point, we will leave this issue for future research.

The presuppositional status of emotive predicates faced a challenge on the basis of the mistaken-belief examples, which leads to the second question our experiment tried to address, namely the extent to which mistaken-belief contexts are considered marked. Our results clearly suggest that emotive predicates are fully acceptable in the *mistaken belief* condition, as if all the presuppositions of the sentences containing them were met in our items. In this condition, the truth of the complement of the embedded clause is explicitly negated, as this is an entailment of a *mistaken believe* statement, as shown in (16), context of (14a).

(16) The duck mistakenly believes that the panda made the roses die.
Entails: The panda did not make the roses die.

Instead, we find complete unacceptability for the $\neg p$ *and* manipulation, which just as well entails that the complement of the emotive predicate in the item is false. Hence, unless the *mistaken belief* component is explicitly introduced, negating the complement of the emotive predicate in these items has the same effect as presupposition failure. This reproduces an intuition that was already present in the literature, but by doing so in a systematic, controlled, and empirically robust way, we establish a baseline for the discussion that follows.

7 Additionally, Romoli analyzes the projection of the inference under negation as an indirect scalar implicature. What we here call local accommodation for semi-factives in conditional antecedents might just be the absence of a presupposition for Romoli (2015).

Under the assumption that presupposition triggering is determined lexically and not contextually — unlike presupposition projection, — we are forced to think that the emotive predicates of our items, *be angry* and *be sad*, trigger the same presupposition regardless of the experimental manipulation. Thus, if the presupposition of emotive predicates were factive, standard tools that affect presupposition projection are of no use in characterizing the contrast between these two conditions: given that all we have is a mistaken belief statement coordinated with the emotive report, there is no context where a factive presupposition could be satisfied. More concretely, a conjunct of the form $\ulcorner \neg \phi$ *and x believes that* $\phi \urcorner$ (equivalent to a mistaken belief report) does not provide a context where a presupposition with content ϕ can be satisfied.

According to our definition in Section 1, presuppositions are admittance conditions that sentences place on contexts. The acceptability of emotive predicates in mistaken-belief contexts suggests that their presupposition is not factive. If it were, by our definition, they could never be used in contexts where their complement is not established as true. Yet, mistaken-belief examples show that they can be used in those cases, and without a penalty that our experiment could detect. Therefore, an account of emotive predicates will have to explain why emotive predicates, on the assumption that they always trigger the same presupposition, behave as if they were factive in all contexts except contexts of mistaken belief.

3 Why unstable factivity is a mistaken belief

In the following sections we will attempt a reconciliation of these incongruent-seeming facts. We will start from the option offered by Karttunen (2016) of renaming the factive inference an implicature. After rejecting this option as unsatisfactory, we will turn to Abrusán (2022), who does consider a presupposition-based account. To explain the acceptability of emotive predicates mistaken-belief contexts, Abrusán allows for a different mode of interpretation, inspired by the context shift operations known from the literature on *free indirect discourse*. We will argue that, while this interpretative shift might capture the acceptability of factives in some mistaken-belief contexts, it runs into problems with variable binding with quantified subjects, and reject it on these grounds.

Before turning to our own proposal, we will consider the case of *be odd*, argued in Karttunen (2016) to be an emotive predicate with a genuine factive presupposition, contrary to predicates like *regret*, because of their unacceptability in mistaken-belief contexts. We will see that, indeed, a factive presupposition is triggered in this case. However, we will also see that once we take into account how perspective sensitivity is encoded syntactically, even such a seemingly truly factive predicate becomes acceptable in contexts involving mistaken beliefs. In fact, we

will argue that this is a completely general and two-sided phenomenon: on the one hand, all presuppositions can be relativized to a belief state by embedding them in the appropriate syntactic context. On the other hand, all belief-relative presuppositions behave just like the presupposition of emotive predicates, which are only exceptional in triggering a belief-relative presupposition out of the box.

3.1 What kind of implicature, if any?

At this point, it has been established that for the solution of our puzzle, no principle of presupposition weakening should be invoked, such as softness: emotive predicates behave differently from semi-factives and should be classified as hard triggers. We will now discuss, and ultimately reject, the option of calling the factive inference an implicature associated with emotive predicates, as entertained in Karttunen (2016), basing this conclusion on their projective behavior.

It is a known fact that certain well-studied conversational implicatures, like scalar implicatures, tend not to be computed in conditional antecedents. Consider, for example, the scalar implicature associated with disjunction, such that in upward-entailing environments, $\ulcorner \phi$ *or* $\psi \urcorner$ implicates that *not both* ϕ *and* ψ. When a disjunction is embedded in the antecedent of a conditional, the scalar implicature is neither computed locally nor does it project. This is shown in (17). This behavior is clearly different from that of the factive inference we are trying to explain. If the content of the factive inference of emotive predicates were only implicated in plain affirmative sentences, we would expect a behavior similar to (17) under embedding, against the unacceptability that we found.

(17) If Taro broke the vase or the lamp, Abigail will be mad.
$\not\rightsquigarrow$ If Taro did not break both the vase and the lamp, Abigail will be mad.
$\not\rightsquigarrow$ Taro did not break both the vase and the lamp.

Karttunen (2016) suggests that the factive inference should nonetheless be called a generalized conversational implicature, but in our view, this move at most restates the problem.[8] The label of *conversational implicature* is a way of repeating that the

8 The claim in Karttunen 2016 is reminiscent of an argument that can be found in Karttunen & Peters 1979 against the treatment of evaluative verbs as presuppositional. Consider the examples in (18) from Karttunen & Peters 1979: p. 11: although a sentence containing *criticize* normally conveys the existence of a fact the evaluation is grounded on, Karttunen & Peters argue that this inference can be canceled and is therefore an implicature.

(18) a. John criticized Harry for writing the letter.
$\rightsquigarrow$ Harry is responsible for writing the letter.
b. John criticized Harry for writing the letter. Since the letter was written by Mary, it was quite unfair of John.

inference can be canceled in some contexts — leaving underspecified why it arises in the first place, — and what it crucially does not explain is why the inference *projects* like a presupposition.[9]

Lastly, one might want to consider the possibility of a conventional implicature. One of the most in-depth investigations of conventional implicatures is the one by Potts (2005), who focuses on a specific type thereof. Within the class of conventional implicatures falls the content introduced by non-restrictive relative clauses. Crucially, this content is always not at-issue and it projects out of entailment canceling operators, which resembles the behavior of a presupposition (see Chen, Thalmann & Antomo 2022 for experimental results about at-issueness and an explicit comparison with soft and hard triggers).

Nonetheless, we believe that the behavior of the contribution of non-restrictive relative clauses does not match that of the factive inference of emotive predicates. Non-restrictive relative clauses necessarily contribute new information, but this is not the case for our factive inference. Introducing a non-restrictive relative clause with well-known or just mentioned content sounds unacceptable. This is exemplified by the contrast between the two continuations in (20), where the same information can be resumed by the factive inference of *be happy*, but not by a non-restrictive relative clause.

(20) Skye saw Aditi at the park,

a. #and Aditi, who was seen by Skye, was happy.

b. and Aditi was happy to be seen by Skye.

Additionally, conventional implicatures are often considered impossible to cancel, and this is most likely the case for the contribution of non-restrictive relative clauses. Instead, we would like to explain why the factive inference of emotive predicates is systematically canceled in a specific type of context. All in all, the factive inference of emotive predicates should not be classified as a kind of implicature, conventional or conversational, because an analysis along these lines leaves unexplained some crucial empirical facts about this inference. In the next section, we

It is not impossible that cases like (18) deserve a treatment similar to the one we will give to emotive predicates, though we will not discuss these cases.

9 It has been proposed that scalar implicatures might arise from a mechanism of presuppositional exhaustification (Bassi, Del Pinal & Sauerland 2021), which can lead to a process of projection of an implicature-like inference. To achieve this for emotive predicates, a sentence like (19a) should have (19b) as its *scalar* alternative, negated by presuppositional exhaustification to return the factive inference. Given the substantial syntactic difference between (19a) and (19b), we find this possibility implausible.

(19) a. Aditi was happy to be seen by Skye.

b. Aditi was not seen by Skye.

will consider the approach by Abrusán (2022), which, in line with our view, takes for granted the assumption that factivity is presuppositional.

3.2 A case akin to free indirect discourse?

Instead of splitting up the class of factive predicates into a sub-group with presuppositions and one with conventional implicatures, it might be possible to interpret the acceptability of (3) as the result of satisfying the presupposition of the predicate from the perspective of the attitude holder. After all, the attitude holder's knowledge is not aligned with the speaker's. This idea was also considered — but not pursued — by Egré (2008), along the lines of what Gazdar (1979) suggests for certain examples with cognitive factive verbs.

Starting from this intuition, Abrusán (2022) argues in favor of an approach called *protagonist projection* (cf. Holton 1997), according to which utterances, especially in these misalignment scenarios, can be interpreted with respect to either the external context or the beliefs of some protagonist (similar, but not identical, to free indirect discourse). This affects not only the assertion, but also other meaning components such as presuppositions.

Abrusán's proposal works as follows. Besides the *context of utterance* C, which is relative to the speaker, it is possible to introduce an *internal context* d relative to the protagonist (following Eckardt 2015, among others), which can establish a different mode of interpretation for a sentence. When an internal context and its protagonist are made salient in the discourse, some parameters of the language — such as author, time, location, possible world — can be interpreted relatively to that internal context d instead of the context of utterance, resulting in a bi-contextual interpretive mode. Example (21), following Abrusán (2022: p. 597), illustrates how a sentence under this perspective shift may receive an interpretation.

(21) If d is a context of thought, and the single-mode interpretation of a sentence ϕ, call it $[\![\phi]\!]^C$, is the proposition p, then its bi-contextual interpretation $[\![\phi]\!]^{\langle C,d\rangle}$ is:

$$\lambda w\,.\ \mathsf{author}_d \text{ thinks in } w \text{ that } p \text{ is true},$$

where author_d is the protagonist of the internal context d.

From the possibility in (21), Abrusán derives the following principle to interpret presuppositions under protagonist projection:

(22) "Presuppositions of sentences interpreted in a bi-contextual mode need to be satisfied in the beliefs of the protagonist."

(Abrusán 2022: p. 598)

In effect, the bi-contextual mode allows for a belief-relative interpretation of all kinds of meanings, provided that there is a protagonist salient enough whose belief-worlds we can consider. For our mistaken-belief scenario in (3), this means that the attitude holder is treated as a protagonist from whose perspective we may evaluate presuppositional requirements. This then allows for an explanation as to why in our sentences no presupposition failure is detected upon encountering the emotive predicate: since the attitude holder of the emotive predicate is the protagonist of the internal context, the presupposition, when interpreted in bi-contextual mode, is interpreted and satisfied in their beliefs and no presupposition failure arises.

(23) In a context where *John wrongly believes that Mary got married*, which establishes d as a context of John's beliefs, the interpretation

$$[\![\text{John regrets that Mary is no longer single}]\!]^{\langle C,d\rangle} \qquad \textit{(after (3))}$$

a. is *defined* only if John believes that Mary is no longer single;
b. is *true* only if John believes that he regrets that Mary is no longer single.

We outline two reasons why we believe that this solution is not ideal. In the system by Abrusán (2022), shifting the context of interpretation from the speaker to some protagonist is only constrained by the salience of a protagonist, and so in principle, any salient individual should be available as the author. In a case like (24), we would then expect it to be possible to shift the interpretation to Taro's perspective, if Taro is made the protagonist of the discourse. Since Taro indeed believes that Kostas is very rich in the context of (24), the factive presupposition is predicted to be satisfied in the beliefs of the protagonist. This option, however, does not seem to us to be available, as evidenced by the quite pronounced infelicity of the sentence in the context.

(24) CONTEXT: *Taro believes that unbeknownst to Aditi, Kostas is very rich.*
Aditi is happy that Kostas is so rich.

However, it may be possible to enrich this approach and to impose certain limits on the availability of protagonist or the availability of the bi-contextual mode of interpretation. Yet, even if this more complex system were to then successfully derive the infelicity of (24), there is one more issue that we believe is more serious and not remedied by these additional constraints on bi-contextual interpretations.

This issue arises if the subject of the emotive predicate binds into the embedded clause. In quantified sentences like (25) below, where the belief-relative presuppositions differ across attitude holders, it is not possible to define an internal context that can shift the interpretation and ensure that no presupposition failure arises, while keeping the sentence's intended meaning and binding configuration.

(25) CONTEXT: *The professor of a career-defining class falsely informed each of the students privately that only her exam was not a fail.*
Every student$_i$ was happy that she$_i$ passed.
$\not\rightsquigarrow$ The students thought that every one of them passed.
$\not\rightsquigarrow$ The students thought that every one of them was happy that she passed.

In (25), for example, the plurality of students is not a good candidate to be the protagonist of an internal context of interpretation. If the sentence were interpreted in an internal context whose protagonist is the plurality of students, the proposition that *every student$_i$ was happy that she$_i$ passed* would be a belief held collectively by the plurality of students. This paraphrasis and the unattested inferences in (25) show that the definedness and truth conditions of the sentence are not captured correctly. It is not true that the students think that every one of them passed because the professor told each student that she was the only one to pass. It is also not necessarily true that the students think that every one of them would have been happy to pass because it is possible to enrich the discourse of (25) and add that some students suspected that others secretly hoped not to pass without affecting felicity.

On the approach by Abrusán, we either expect (25) to be degraded or not to have a meaning it has. The issue arises because intuitively, the requirement that *x has passed the exam* is only satisfied in *x*'s beliefs for each student *x*, but the mechanism of internal contexts does not allow for this type of binding.[10]

Given that the protagonist projection approach leads to overgeneration in cases like (24) and undergeneration in cases like (25), we believe that it does not offer a satisfactory solution to our puzzle. Before we turn to our own proposal, we will first consider a case which seems to lead to a complication of the empirical facts for emotive predicates in mistaken-belief scenarios, first discussed in Karttunen (2016).

3.3 Emotives with clausal subjects and perspective shifts

Mistaken-belief contexts are characterized by the explicit assertion of the speaker that someone holds false beliefs. Throughout, we have seen that predicates like *be sad* do not lead to infelicity here, despite what the assumption of a factive presuppo-

10 There is another case that perhaps makes this point even more strikingly, if on the basis of an additional assumption. If we grant that *other* in (26) contains a variable that can be bound by the quantified subject, then the only way to generate an appropriate interpretation is by not having the plurality of students as a protagonist:

(26) CONTEXT: *The professor of a career-defining class falsely informed each of the students privately that no exam was a fail.*
Every student$_i$ was sad that the other$_i$ students had passed.

sition would have us expect. Factives that take clausal subjects, like *be odd*, do not seem at first to have equivalent rescuing scenarios, as shown by the contrast between (14a), repeated below, and (27). For this reason, Karttunen (2016) advocates for a reconsideration of the presuppositional status of the triggers in the former group, calling *factive* only those in the second group. While we agree on the contrast, we disagree on the driving force behind it.

(14a) The duck mistakenly believes that the panda made the roses die, and she's angry that he made them die.

(27) #The duck mistakenly believes that the panda made the roses die, and it's odd that he made them die.

Notice first that in (27), *be odd* is interpreted as a judgment that originates from the speaker. This is different from (14a), where the evaluative attitude is interpreted as the duck's. This is a characteristic feature of some perspective-sensitive predicates: the default interpretation is a speaker-relative one (Lasersohn 2005, Stephenson 2007, Pearson 2013), but the perspectival center can be shifted. In the case of *be odd*, this can be done with a dedicated prepositional phrase. Consider the sequence of examples in (28): if the perspectival center is the speaker, as it is by default, the speaker is ascribed both the belief that Eleni likes frogs and the judgment that Eleni liking frogs is odd. If a PP is used to introduce Taro as a perspectival center, Taro is instead ascribed both the belief that Eleni likes frogs and the judgment that Eleni liking frogs is odd. Additionally, the inference is drawn that it is indeed true that Eleni likes frogs. Notably, the last inference can be canceled in a mistaken-belief context, (28c). It appears to be crucial here that the non-default perspectival center is overtly realized as a PP, otherwise we encounter infelicity, (27).

(28) a. It's odd that Eleni likes frogs.
  $\rightsquigarrow$ Eleni likes frogs.
  $\rightsquigarrow$ The speaker finds it odd that Eleni likes frogs.

  b. It's odd to Taro that Eleni likes frogs.
  $\rightsquigarrow$ Taro believes that Eleni likes frogs.
  $\rightsquigarrow$ Taro finds it odd that Eleni likes frogs.
  $\rightsquigarrow$ Eleni likes frogs.

  c. Taro mistakenly believes that Eleni likes frogs, and it's odd to him that she does.
  $\rightsquigarrow$ Taro believes that Eleni likes frogs.
  $\rightsquigarrow$ Taro finds it odd that Eleni likes frogs.
  $\not\rightsquigarrow$ Eleni likes frogs.

The distribution of the PP "to DP" looks idiosyncratic: a similar predicate, namely *be awkward* does not allow for it, and the perspectival shift has to be expressed with a more wordy adjunct. This is shown in (30), which reproduces the same perspective shift as above. The phrase *according to*, used below, seems to introduce a belief holder that behaves like a perspectival center, and this works just like the phrase *to Taro* for our purposes.[11]

(30) a. *It's awkward to Taro that Eleni likes frogs.
b. According to Taro, it's awkward that Eleni likes frogs.

These data suggest that whether and how a perspectival center is expressed is, at least partially, a syntactic fact. An insightful semantic generalization can come not from observing who the center is, but rather, how the center behaves. We argue that it behaves in a way that introduces a belief-relative presupposition, and state the generalization in (31).

(31) **Belief-relative presuppositions:**
A perspective-sensitive evaluative predicate presupposes that the individual being the perspectival center believes that the clausal argument denotes a true proposition.

At best then, the contrast between *be odd* and *be sad* is a matter of how the perspectival center is introduced, and whether it is shifted away from the speaker, and not a matter of the presuppositional status of the predicates, contrary to the characterization in Karttunen (2016).

3.4 A presupposition after all

All we have said about evaluative predicates with clausal subjects like *be odd* and *be awkward* translates naturally to emotive predicates, like *be happy* and *regret*, which take an attitude holder, and hence a perspectival center, as an obligatory argument — in fact, as their subject. They give rise to a presupposition such that that the individual being the perspectival center must believe that the embedded proposition is true. Additionally, unless uttered in a context of mistaken belief, the inference arises that the embedded proposition is indeed true.

11 Notably, *according to* does not merely introduce an attitude report that keeps the perspectival center unshifted. If it did, it would compositionally return a belief report about the speaker's judgment. However, such an operator seems not to exist in English, as shown by the fact, illustrated in (29), that even the prototypical attitude predicate *believe* is a perspective shifter.

(29) Taro believes that it's awkward that Eleni likes frogs.
$\rightsquigarrow$ Taro finds it awkward that Eleni likes frogs.
$\not\rightsquigarrow$ Taro believes that the speaker finds it awkward that Eleni likes frogs.

We will now support our initial characterization of the belief-relative presupposition as genuine. First of all, the belief requirement intuitively projects out of entailment-canceling operators at least as strongly as the factive inference we tested with our experiment. This is shown in (32) for negation and a conditional antecedent.

(32) a. Taro is not happy that Eleni likes frogs.
⇝ Taro believes that Eleni likes frogs.

b. If Taro is happy that Eleni likes frogs, he will invite her for a walk.
⇝ Taro believes that Eleni likes frogs.

A conditional antecedent that entails a (possibly mistaken) belief identical to the belief-relative presupposition is sufficient to filter the presupposition of an emotive statement and make it felicitous, as shown in (33).

(33) If Taro mistakenly believes that Eleni likes frogs, he's happy that she does.

Further, and crucial with respect to our experimental findings, its presuppositional behavior seems to match that of a hard presupposition: in (34), we test for local accommodation in a conditional antecedent and for at-issueness (the latter following Chen, Thalmann & Antomo 2022). Encouragingly, these cases strike us as infelicitous, as expected for a hard presupposition, and they constrast with the good cases in (35), which contain the soft trigger *win* embedded under *think*.

(34) a. #I don't know if Taro thinks that Eleni ran the marathon, but if he's happy that she ran it, he will invite her out for dinner.

b. A: Does Taro think that Eleni ran the marathon?
B: #He's happy that she ran it.

(35) a. I don't know if Taro thinks that Eleni ran the marathon, but if he thinks that she won it, he will invite her out for dinner.

b. A: Does Taro think that Eleni ran the marathon?
B: He thinks that she won it.

Finally, the belief-relative presupposition is never cancelable. Consider a context of ignorance, as in (36), where the factive inference is in principle met (introduced by the presupposition of the *know* statement) but the belief-relative presupposition is not satisfied. In this context, the emotive report is infelicitous.

(36) #Taro doesn't know that the Eleni likes frogs, and he's happy that she does.

This last point reveals a crucial asymmetry between the factive inference and the belief-relative presupposition: the former is cancelable as long as the latter is satisfied (in mistaken-belief contexts), but the opposite is not possible.

We think it is safe to conclude that what we called a belief-relative presupposition is indeed a presupposition. We have now identified a hard presupposition triggered by emotive predicates, namely the presupposition that the perspectival center believes the embedded proposition, and we want to derive the presupposition-like behavior of the additional factive inference. Given the asymmetry just discussed, it seems natural to derive the factive inference from the belief-relative presupposition and to let the projective properties of the former be the result of the projective properties of the latter. Discussing a mechanism that achieves that will be the goal of the next section.

3.5 Reverberating beliefs

Establishing such a mechanism is the goal of Thalmann & Matticchio (2025). In this work, a pragmatic principle is proposed, following intuitions already present in the literature (Karttunen 1973, Heim 1992, Geurts 1999, Sudo 2014), that derives the factive inference from the belief-relative presupposition of emotive predicates. This principle is reported in (37).

(37) **Echochamber:**
For any context c, given a certain animate entity x and proposition p, if c entails p, then c entails that x believes that p, unless x's ignorance about p is conveyed in the discourse.

This principle is made up of two parts: its main contribution is a form of pragmatic closure of a context. Contexts are closed under third parties' beliefs, such that the default assumption is that people we talk about share our beliefs. The second component — the *unless* clause — specifies the condition in which the closure principle is suspended. Being able to suspend *Echochamber* is necessary to allow natural language to talk about people's beliefs being different than our own: in the examples in (38), *Echochamber* is suspended for Taro and the proposition that Eleni likes frogs, given that Taro's ignorance or mistaken beliefs are conveyed explicitly.

(38) a. Taro doesn't know that Eleni likes frogs.
b. Taro mistakenly believes that Eleni doesn't like frogs.

What *Echochamber* derives, following Thalmann & Matticchio (2025), is that sentences that carry belief-relative presuppositions lead to a choice of global accommodation that corresponds to the factive inference. On this view, factivity is

not a lexical presupposition of emotive predicates, but is rather derived from the belief-relative presupposition via accommodation as long as *Echochamber* remains in effect.

Generally, when a sentence is uttered in a context that is silent about the truth of its presupposition, speakers may use global accommodation to minimally update the context and meet the presupposition. One prominent examples of this is the case of so-called informative presuppositions (von Fintel 2008: p. 140):

(39) I am sorry that I am late. I had to take my daughter to the doctor.

In (39), the possessive pronoun presupposes that the speaker has a daughter. If the addressee is ignorant of this fact, we ordinarily expect presupposition failure; that the second sentence in (39) is felt to acceptable is ordinarily explained by global accommodation: the context is updated so that the presupposition is met, and the sentence is felicitous.

In the case of emotive predicates, given that the accommodated context must comply with *Echochamber* unless suspended, global accommodation returns a context where the speaker's and the attitude holder's beliefs are aligned, that is, one that entails the factive inference. Therefore, a factive inference is brought about by global accommodation for a sentence that carries a belief-relative presupposition, and its projective behavior is the result of projection of the belief-relative presupposition itself: whenever a belief-relative presupposition projects and imposes a requirement on the global context, *Echochamber* forces a context of belief-alignment unless reason is explicitly given to suspended it.

A formalization and a full discussion of how *Echochamber* applies to a broad variety of examples with emotive predicates, including cases of apparent filtering of the factive inference, can be found in Thalmann & Matticchio 2025. What is important in the justification of *Echochamber* is that it gives a way of capturing the behavior of presupposition triggers embedded under attitude predicates in general, in a way completely parallel to emotive predicates.

We have already seen in Section 3.3 that shifting the perspectival center of *be awkward* by introducing a belief holder shifts its presupposition to that holder's beliefs, too. This seems to be part of a fully general phenomenon that does not only apply to the presupposition of evaluative predicates. The examples in (40) show that when a presupposition trigger is embedded under *believe*, a belief-relative presupposition arises, which additionally leads to a global inference in most contexts. However, in mistaken belief contexts, the latter inference can be canceled. This behavior was studied by Heim (1992) among others.

(40) a. Skye believes that Aditi lost the kite again yesterday.
⇝ Skye believes that Aditi lost the kite before yesterday.
⇝ Aditi lost the kite before yesterday.

b. Skye mistakenly believes that Aditi lost the kite before yesterday, and they believe that she lost it again yesterday.
   ⇝ Skye believes that Aditi lost the kite before yesterday.
   ↛ Aditi lost the kite before yesterday.

The behavior of this inference is predicted by *Echochamber* just like the factive inference of emotive predicates. The only difference is that the former is derived compositionally, by embedding the presupposition trigger in complement of *believe*, while the latter comes lexically with emotive predicates.[12]

3.6 Two potentially problematic cases

One case not discussed by Thalmann & Matticchio (2025) is offered by Geurts (1999: p. 165) in support of the idea that the global inference in (40) should be treated as a presupposition, and not derived pragmatically. In an example like (41a), the sentence carries a belief-relative presupposition, which is derived by embedding a belief report under the presuppositional *know*, but no global inference is derived, unlike in (41b).

(41) a. Fred knows that John believes that it was raining.
   ⇝ John believes that it was raining.
   ↛ It was raining.

b. John believes that it stopped raining.
   ⇝ John believes that it was raining.
   ⇝ It was raining.

Geurts's challenge is as follows: (41a) and (41b) have the same belief-relative presupposition, but only in one case does the pragmatic reasoning apply that derives the global inference. We believe that on the formalization of *Echochamber* given by Thalmann & Matticchio (2025), the absence of the global inference in (41a) follows naturally from an interplay with the principle of *Maximize Presupposition!* (Heim 1991).

In order to establish whether *Echochamber* is suspended at a point in discourse when a certain sentence S is uttered, one has to consider what the meaning of S is: if S conveys belief misalignment for a belief holder x and a proposition p, *Echochamber* is suspended for x and p. In general, third-person *believe* statements give rise to *Maximize Presupposition!* effects, also called anti-presuppositions (**percus2006antipresupposition**), that convey that the reported proposition might be false. This can be derived as the

12 Although there might be a relation between the two triggering processes, Thalmann & Matticchio (2025) argue that an implementation of this idea that makes use of syntactic decomposition, following Kastner (2015), is undesirable.

competition with a non-uttered alternative that achieves a stronger presupposition by replacing *believe* with *know* (Sauerland 2008). Exactly the same reasoning can apply to the sentence in (41a), as described in (42). Instead, (41b) does not have a similarly generated alternative that could lead to an anti-presupposition.

(42) a. Fred knows that John knows that it was raining.
presupposes: It was raining.
b. Fred knows that John believes that it was raining.
does not presuppose: It was raining.
and anti-presupposes: It might have not been raining.

Anti-presuppositions are subject to global accommodation. If a sentence carrying an anti-presupposition is uttered out of the blue, global accommodation takes that into consideration and adjusts the context so that it is satisfied. This is exemplified in (43), where the inference is drawn by default. Here, the anti-presupposition is due to a competition with an alternative that replaces the determiner *a* with the definite *the*, which carries a uniqueness presupposition.

(43) A daughter of Abigail's likes frogs.
$\rightsquigarrow$ Abigail has more than one daughter.

Given this observation, let us consider (41a) again. When global accommodation applies, it takes the antipresupposition into consideration. In the example, the sentence's presupposition and anti-presupposition taken together convey belief misalignment: it is presupposed that John believes that it was raining, and it is anti-presupposed that it might have not been raining. Therefore, *Echochamber* is suspended for John and the proposition $[\lambda w.$ it was raining in $w]$, and no global inference that it was raining is derived, as desired.

Another case that deserves to be discussed is a potential challenge to the idea that the belief-relative presupposition is not a cancelable inference. We argued for this position on the basis of examples like (36) for emotive predicates, which can be replicated for other presupposition triggers under attitude predicates as in (44).

(44) #Taro doesn't know that Eleni ran the marathon, and/but he thinks that she won it.

However, Heim (1992: p. 209) offers an example where a presupposition triggered in the scope of an attitude predicate seems to be satisfied only in the global context (against local satisfaction). In order to avoid abandoning the idea that presuppositions are evaluated locally, she suggests that the presupposition — or the presupposition trigger — might be read *de re*. The example is reported in (45). Here, the target sentence is judged as felicitous even if Mary's parents are not assumed to

know whether John is in bed or not. If local satisfaction requires a presupposition to be evaluated in the local context, the presupposition that John is in bed, introduced by the trigger *also*, should be satisfied in all of Mary's parents' doxastic alternatives.

(45) CONTEXT: *Two kids are talking to each other on the phone.*

John: I_1 am already in bed.

Mary: My parents think that I_F am also_1 in bed.

In a related endnote, Heim (1992: p. 219) discusses a similar case, reported here in (46), where the presupposition displays a different behavior. In this case, the presupposition cannot be satisfied despite it being true in the global context, where John actually got the job. This contrast is left as a puzzle: no similar alleged *de re* presupposition is possible in this context. As Heim says, the reason why (46) is out should be that Mary's parents know that only one person could get the job, and a *de re* reading of the presupposition cannot achieve this result.

(46) CONTEXT: *John and Mary competed for one job, and everybody, including the parents, knew this.*

John: I_1 got the job.

Mary: #My parents think that I_F also_1 got it.

If (45) does not presuppose, as Heim says, a context where Mary's parents share the belief that John is in bed, the acceptability of the utterance cannot be due to a principle like *Echochamber*. Instead, an operation of *belief strengthening* could be applied along the lines discussed by Blumberg & Lederman (2021). The intuition behind their belief strengthening operation is that we can generally talk about agents' doxastic states by reporting what they "*would* believe if they were a part of our conversation, and knew what we know" (Blumberg & Lederman 2021: p. 760).

Under this proposal, Mary's utterance in (45) is defined and true because there is a backgrounded proposition that John is in bed, and Mary's parents' beliefs, once restricted with this proposition, entail that Mary is *also* in bed, the presupposition of *also* being satisfied in the restricted beliefs.

(47) Let $\text{DOX}_{\text{Mp}}^{w_0}$ be the conjunction of the beliefs that Mary's parents hold in the actual world w_0. Mary's utterance in (45) is defined and true because:

$$\left(\text{DOX}_{\text{Mp}}^{w_0} \cap [\![\text{John is in bed}]\!]\right) \subseteq [\![\text{Mary is } \textit{also} \text{ in bed}]\!].$$

The exact conditions in which such a strengthened interpretation of *believe* is possible might require future investigation. However, it is relevant that a similar move leads to a deviant interpretation for the unacceptable case in (46). If Mary's

parents are aware that only one person can get the job and believe that that person was Mary, the intersection of their beliefs with the proposition that John got the job is empty. A constraint that prevents a belief report to be true because of an empty doxastic state (here, after strengthening) would be reasonable to assume, and a similar move is made by Thalmann & Matticchio (2025) about *Echochamber*.[13]

The pragmatic justifications of *Echochamber* by Thalmann & Matticchio (2025) and *belief strengthening* by Blumberg & Lederman (2021) admittedly share some similarities, but their empirical coverage is distinct. Whether these two mechanisms should be unified and how must be left for future research.

4 Conclusion

We have shown with our experimental results that emotive predicates like *be angry* and *be sad* generally give rise to a factive inference that behaves like the hard presupposition of additive particles. The only contexts in which this inference does not have to be satisfied are mistaken belief scenarios, where emotive predicates are fully acceptable. To resolve the tension that a purely factive presupposition would give rise to in mistaken belief contexts, we advocated for an analysis that assigns these predicates a belief-relative presupposition, rather than abandoning a presuppositional analysis as argued for in Karttunen 2016. With a belief-relative presupposition, no contradiction is predicted in mistaken-belief contexts, contrary to the predictions of a more classical factive account for these predicates.

By adopting the account by Thalmann & Matticchio (2025), the factive inference can be derived as the result of global accommodation once a pragmatic principle, called *Echochamber*, is in place, rather than positing a lexical basis. Given this mechanism, if emotive predicates are hard triggers with a belief-relative presupposition, a sentence where this presupposition projects superficially behaves like a sentence where a factive presupposition has projected — unless *Echochamber* is suspended and no factivity intuition is predicted. An attractive feature of such an account is that it generalizes to evaluative predicates with clausal subjects and the behavior of presupposition triggers embedded under *believe*: every time a belief-relative presupposition is derived, *Echochamber* may apply, and the same behavior as the one we have seen with predicates like *be happy* is expected.

We noticed a similarity between all the cases above. Evaluative predicates, regardless of their argument structure, presuppose that the agent corresponding to their perspectival center believes that the complement is true. When no perspectival

13 The system by Blumberg & Lederman (2021) allows for a subtype of these cases: according to them, belief reports can be true if the agent would believe the report after *revising* their beliefs with a backgrounded proposition. However, in the context of (46), Mary's parents would not believe that Mary got the job after learning that John did.

center is realized syntactically, the speaker becomes the center by default, but shifting the perspectival center is possible via operators that create attitudinal contexts. In fact, on the other hand, predicates like *believe* regularly tamper with presupposition projection and lead to an evaluation of the presupposition in the scope of the attitude, which overall results in a belief-relative presupposition. A comprehensive explanatory account of all these cases will be left to future research.

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A Experimental materials in Italian

(48) First sub-experiment; see (8)

a. *too, again*

i. Il panda non ha rubato nulla alla rana, ma se le
the panda.M NEG has stolen nothing to-the frog.F but if her.DAT
ha rubato anche il cappello, la rana gli strapperà il
has stolen also the hat the frog.F him.DAT rip_off.FUT the
costume da bagno.
suit for bath

'The panda didn't steal anything from the frog, but if he stole her hat too, the frog will rip off his bathing suit.'

ii. Non so se il panda abbia rubato qualcosa alla
NEG know.1SG if the panda.M has.SUBJ stolen something to-the
rana, ma se le ha rubato anche il cappello, la rana
frog.F but if her.DAT has stolen also the hat the frog.F
gli strapperà il costume da bagno.
him.DAT rip_off.FUT the suit for bath

'I don't know whether the panda stole anything from the frog, but if he stole her hat too, the frog will rip his bathing suit.'

b. *be angry, be sad*

i. La papera non ha perso l' aquilone, ma se il panda è
the duck.F NEG has lost the kite but if the panda.M is
arrabbiato che l' abbia perso, le getterà gli
angry that it.ACC has.SUBJ lost her.DAT throw.FUT the
occhiali da sole in mare.
glasses for sun in sea

'The duck didn't lose the kite, but if the panda is angry that she did, he will hurl her sunglasses in the sea.'

ii. Non so se la papera abbia perso l' aquilone, ma se
NEG know.1SG if the duck.F has.SUBJ lost the kite but if
il panda è arrabbiato che l' abbia perso, le
the panda.M is angry that it.ACC has.SUBJ lost her.DAT
getterà gli occhiali da sole in mare.
throw.FUT the glasses for sun in sea

'I don't know whether the duck lost the kite, but if the panda is angry that she did, he will hurl her sunglasses in the sea.'

c. *understand, realize*

i. La rana non ha truccato il mazzo di carte, ma se il
the frog.F NEG has manipulated the deck of cards but if the
panda capisce che l' ha truccato, la
panda.M understands that it.ACC has manipulated her.ACC
escluderà dal prossimo pigiama party.
exclude.FUT from-the next sleepover
'The frog didn't manipulate the deck, but if the panda understands that she did, he will uninvite her from the next sleepover.'

ii. Non so se la rana abbia truccato il mazzo di
NEG know.1SG if the frog.F has.SUBJ manipulated the deck of
carte, ma se il panda capisce che l' ha truccato,
cards but if the panda.M understands that it.ACC has manipulated
la escluderà dal prossimo pigiama party.
her.ACC exclude.FUT from-the next sleepover
'I don't know whether the frog manipulated the deck, but if the panda understands that she did, he will uninvite her from the next sleepover.'

d. *think, believe*

i. La papera non ha preso il voto massimo, ma se la rana
the duck.F NEG has taken the grade highest but if the frog.F
pensa che l' abbia preso, sarà gelosa.
thinks that it.ACC has.SUBJ taken is.FUT jealous
'The duck didn't get the top grade, but if the frog thinks that she did, she will be jealous.'

ii. Non so se la papera abbia preso il voto massimo,
NEG know.1SG if the duck.F has.SUBJ taken the grade highest
ma se la rana pensa che l' abbia preso, sarà gelosa.
but if the frog.F thinks that it.ACC has.SUBJ taken is.FUT jealous
'I don't know if the duck got the top grade, but if the frog thinks that she did, she will be jealous.'

(49) Second sub-experiment; see (9)

a. *be angry, be sad*

i. Il panda non ha fatto morire le rose, ma la papera è
the panda.M NEG has made die.INF the roses but the duck.F is
arrabbiata che le abbia fatte morire.
angry that them.ACC has.SUBJ made die.INF

‘The panda did not make the roses die, but the duck is angry that he made them die.’

ii. La papera crede erroneamente che il panda abbia fatto
the duck.F believes mistakenly that the panda.M has.SUBJ made
morire le rose, ed è arrabbiata che le abbia fatte
die.INF the roses and is angry that them.ACC has.SUBJ made
morire.
die.INF

‘The duck mistakenly believes that the panda made the roses die, and she is angry that he made them die.’

b. *understand, realize*

i. La rana non ha rotto il trenino, ma il panda, dopo
the duck.F NEG has broken the toy_train but the panda.M after
aver-lo esaminato, ha capito che la rana l’
have.INF-it.ACC examined has understood that the frog.F it.ACC
ha rotto.
has broken

‘The frog did not break the toy train, but the panda, after examining it, realized that the frog broke it.’

ii. La rana non ha rotto il trenino, ma il panda, dopo
the frog.F NEG has broken the toy_train but the panda.M after
aver-lo esaminato, ha erroneamente capito che la
have.INF-it.ACC examined has mistakenly understood that the
rana l’ ha rotto.
frog.F it.ACC has broken

‘The frog did not break the toy train, but the panda, after examining it, mistakenly realized that the frog broke it.’

B Full model output

Model Parameter	$\hat{R}$	ESS_{bulk}	ETI_{median} (low, high)	HDI_{mode} (low, high)
Intercept[1]	1	37650	-3.1 (-3.53, -2.66)	-3.09 (-3.53, -2.66)
Intercept[2]	1	36428	-2.27 (-2.70, -1.85)	-2.28 (-2.69, -1.85)
Intercept[3]	1	36142	-1.74 (-2.16, -1.32)	-1.74 (-2.16, -1.32)
Intercept[4]	1	35658	-1.37 (-1.79, -0.95)	-1.35 (-1.77, -0.94)
Intercept[5]	1	35188	-0.87 (-1.29, -0.46)	-0.87 (-1.28, -0.45)
Intercept[6]	1	34745	0.062 (-0.34, 0.475)	0.060 (-0.34, 0.480)
additive	1	45104	-1.50 (-2.07, -0.91)	-1.46 (-2.08, -0.92)
semi-factive	1	62809	-0.41 (-0.86, 0.065)	-0.42 (-0.87, 0.055)
true-factive	1	69636	-1.41 (-1.84, -0.99)	-1.43 (-1.84, -0.99)
¬*p if*	1	82485	-0.20 (-0.55, 0.131)	-0.19 (-0.55, 0.131)
additive:¬*p if*	1	69949	-2.03 (-2.78, -1.25)	-2.05 (-2.79, -1.26)
semi-factive:¬*p if*	1	71756	-1.94 (-2.47, -1.40)	-1.95 (-2.47, -1.40)
true-factive:¬*p if*	1	79276	-0.71 (-1.19, -0.21)	-0.72 (-1.19, -0.22)

Table 2 Model output, sub-experiment 1.

Model Parameter	$\hat{R}$	ESS_{bulk}	ETI_{median} (low, high)	HDI_{mode} (low, high)
Intercept[1]	1	26679	-3.19 (-3.77, -2.64)	-3.17 (-3.76, -2.62)
Intercept[2]	1	26777	-2.47 (-3.03, -1.93)	-2.45 (-3.01, -1.92)
Intercept[3]	1	26523	-1.92 (-2.47, -1.39)	-1.93 (-2.48, -1.40)
Intercept[4]	1	26030	-1.46 (-1.99, -0.93)	-1.47 (-1.99, -0.93)
Intercept[5]	1	25752	-1.07 (-1.60, -0.56)	-1.05 (-1.60, -0.56)
Intercept[6]	1	25070	-0.23 (-0.74, 0.288)	-0.25 (-0.73, 0.299)
semi-factive	1	25030	-0.88 (-1.53, -0.19)	-0.90 (-1.54, -0.20)
¬*p and*	1	27847	-3.12 (-3.80, -2.39)	-3.13 (-3.81, -2.40)
semi-factive:¬*p and*	1	29445	1.061 (0.129, 1.902)	1.054 (0.159, 1.927)

Table 3 Model output, sub-experiment 2.