

The information-structural source of projection variability

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Abstract

1 Introduction

Projective content is utterance content that the speaker may be taken to be committed to even when the expression that contributes the content occurs in the syntactic scope of an entailment-canceling operator (see, e.g., Chierchia and McConnell-Ginet 1990). The speaker of (1), for instance, is taken to be committed to the content of the complement of *discover*, that Mike visited Alcatraz, since this content is entailed by the utterance. The so-called Family-of-Sentences variants of (1) given in (2a-d) do not entail this content because *discover* is embedded under entailment-canceling operators: negation in (2a), the polar question operator in (2b), the epistemic possibility modal *perhaps* in (2c) and the antecedent of a conditional in (2d). Since speakers who utter the sentences in (2a-d) may nevertheless be taken to be committed to the content of the complement, this content, by virtue of being able to ‘project’ over the entailment-canceling operators, is considered projective content.

- (1) Felipe discovered that Mike visited Alcatraz.
- (2) a. Felipe didn’t discover that Mike visited Alcatraz.
b. Did Felipe discover that Mike visited Alcatraz?
c. Perhaps Felipe discovered that Mike visited Alcatraz.
d. If Felipe discovered that Mike visited Alcatraz, he’ll get mad.

Why does projective content project? According to mainstream ‘conventionalist’ approaches, projective content projects because it is conventionally specified to do so, for instance, by being required to be entailed by or satisfied in the common ground of the interlocutors (e.g., Heim 1983; van der Sandt 1992; Geurts 1999). On such approaches, the lexical entry of *discover* specifies that the content of its clausal complement is required to be entailed by or satisfied in the common ground of the interlocutors, thereby ensuring that the speaker is taken to be committed to the content. Since conventionalist approaches only distinguish projective and non-projective content, such approaches are challenged by the long-standing observation that some projective content projects less robustly than other such content. In the early 1970s already, Karttunen (1971) pointed out that the content of the complement of *regret* in (3a) is more robustly projective than the content of the complement of *discover* in (3b); following Karttunen 1971, predicates like

discover have since been referred to as ‘semi-factive’, in contrast to their ‘factive’ counterparts like *regret* (and ‘non-factive’ predicates like *believe*). In Schlenker 2010, the predicate *announce* was referred to as a ‘part-time trigger’ because the content of its complement may, but often does not, project.

- (3) a. John didn’t discover that he had not told the truth.
- b. John didn’t regret that he had not told the truth. (Karttunen 1971:63)

Similarly, Simons (2001:432) noted, partially based on examples from Chierchia and McConnell-Ginet 1990 and Geurts 1994, that the projection of “some – but crucially, not all” projective content to the common ground of the interlocutors may be suppressed in explicit ignorance contexts. Example (4a), for instance, shows that the projective content of *win* in the antecedent of the conditional, that John participated in the race, need not be part of the common ground of the interlocutors, i.e., need not project. On the other hand, the existential implication of the cleft in (4b), that there is an individual who read the letter, must be part of the common ground of the interlocutors, i.e., must project. Expressions like *win* are referred to as ‘soft triggers’, in contrast to ‘hard triggers’, like the cleft.

- (4) a. I have no idea whether John ended up participating in the Road Race yesterday. But if he won it, then he has more victories than anyone else in history. (Abusch 2010:39)
- b. #I have no idea whether anyone read that letter. But if it is John who read it, let’s ask him to be discreet about the content. (Abusch 2010:40)

Experimental research has also provided preliminary evidence for projection variability. Xue and Onea (2011) observed that the content of the complement of German *wissen* ‘know’ is less projective than the content of the complement of *erfahren* ‘find out’, both of which are less projective than the relevant projective contents of sentences with *auch* ‘too’ (that a parallel event is contextually salient) and *wieder* ‘again’ (that the relevant event has happened before). Similarly, Smith and Hall (2011) found that the projective contents of *win* and *know* are less projective than the content implication of English definite noun phrases (e.g., for *the queen*, that the referent is a queen). Interestingly, they also found that the existential implication of cleft sentences, considered a hard trigger, was (numerically) less projective than the relevant contents of the soft triggers *win* and *know*. Thus, the sparse experimental evidence confirms some but not all of the intuitions about projection variability reported in the literature.

Observations about projection variability challenge conventionalist approaches to projection because such approaches do not offer an explanation for why some projective content seems to project less robustly than other such content. After all, under such approaches, any expression that contributes projective content lexically specifies that the relevant content is required to be entailed by or satisfied in the common ground of the interlocutors. The lexical specifications of expressions like *regret*, *discover*, *win*, clefts and definite noun phrases thereby predict that their relevant contents can project, but do not predict differences in how robustly the contents project. Referring to triggers of projective content as ‘semi-factive’ or ‘soft’, as opposed to ‘factive’ or ‘hard’, serves to remind of projection variability but does not address the challenge that this variability poses for conventionalist approaches to projection.

One possible explanation for projection variability is that the projectivity of such content derives from a property that projective content shares, but shares to varying degrees. Simons et al. (2010) proposed that this property is ‘at-issueness’, i.e., the ability of content to address the Question Under Discussion (QUD; e.g., Roberts 2012). Specifically, Simons and her colleagues proposed that utterance content projects if and only if it is not at-issue with respect to the QUD addressed by the utterance. This proposal predicts, for instance, that the content of non-restrictive relative clauses projects more robustly, by virtue of being not at-issue (Potts 2005), than the content of the complement of *discover*, which can be at-issue (Simons 2007). In (5a), for instance, the content of the non-restrictive relative clause in B’s utterance cannot be used to address A’s question, and hence is not at-issue, in contrast to the main clause content of B’s utterance, as

shown in (5b). The content of the complement of *discover* in B's utterance in (6a), on the other hand, can address A's question, and hence can be at-issue, but it can also be not at-issue, as shown in (6b), where it does not address A's question.¹

- (5) a. A: Did Mike visit Alcatraz?
 B: #Mike, who visited Alcatraz, is interested in the history of prisons.
- b. A: What is Mike interested in?
 B: Mike, who visited Alcatraz, is interested in the history of prisons.
- (6) a. A: Where was Harriet yesterday?
 B: Henry discovered that she had a job interview at Princeton. (Simons 2007:1035)
- b. A: Why is Henry in such a bad mood?
 B: He discovered that Harriet had a job interview at Princeton.

This paper has two goals, which are explored on the basis of two pairs of experiments. The first goal (Experiments 1a and 1b) is to empirically explore projection variability for a broad range of projective content, in order to better understand the extent to which projection variability presents a challenge for conventionalist approaches to projection. The second goal (addressed through Experiments 1a and 1b, as well as 2a and 2b) is to test the proposal put forth in Simons et al. 2010, that the projectivity of utterance content is influenced by at-issueness, i.e., the information-structural status of such content. These two goals jointly serve to assess the empirical adequacy of conventionalist and Simons et al.'s (2010) approaches to projection and projection variability.

In pursuing our first goal, we expand and improve on previous experimental research. In Xue and Onea 2011 and Smith and Hall 2011, projection variability was explored for 4 German and 6 English expressions that contribute projective content, respectively. Experiments 1a and 1b significantly broaden our understanding of projection variability by considering the projective content of 19 expressions (whose properties are introduced in section 2). Our experiments also take into consideration that the prior plausibility of content may influence projection: a speaker might, for instance, be more likely to be taken to be committed to the content that Alexander flew to New York than to the content that Alexander flew to the moon, simply because people are more likely to fly to New York than the moon. In other words, the content of the projective content of an expression² may matter for how robustly the projective content is taken to be a commitment of the speaker (and how likely the projective content is to address the QUD). The projective content of the 6 expressions explored in Smith and Hall 2011 was only instantiated by one content each and a distinct content instantiated each projective content; similarly, the projective content of the 4 expressions explored in Xue and Onea 2011 was instantiated by three distinct contents each. Our experiments, in contrast, included a total of 37 contents and the projective content of each expression was instantiated by up to 20 contents. Furthermore, to facilitate comparison across the different projective contents (and the expressions that contribute them), the projective contents contributed by distinct expressions were instantiated with the same contents: overall, each of the 37 contents instantiated up to 12 projective contents.

Our second goal, to explore the hypothesis that the information-structural status of projective content influences its projectivity, also builds on previous experimental work. Using a direct dissent diagnostic for at-issueness, Amaral et al. (2011) found that speakers of British English judged direct dissent with the

¹Syrett and Koev (2015) show that the content of non-restrictive relative clauses can be the target of direct denial, which may be taken to suggest that this content can be at-issue. We return to this matter in section 3.

²In this paper, we use 'content' to refer to the content of an expression and 'projective content' to refer to an abstract characterization of the projective content of an expression. For instance, in B's utterance in (6a), the relevant expression is *discover*, the projective content is the content of its clausal complement, and the content (of the projective content) is that Harriet had a job interview at Princeton.

projective content of *only* (the prejacent) to be more acceptable than direct dissent with the projective content of *continue* and *stop* (the pre- and post-states, respectively). These findings suggest that the prejacent of *only* is more at-issue than the post- and pre-state content of *continue* and *stop*. (See also Cummins et al. 2012.) Xue and Onea (2011) found that speakers of German were more likely to directly dissent with the content of the complement of *wissen* ‘know’ than with the content of the complement of *erfahren* ‘find out’ and, in turn, more likely to directly dissent with these contents than with projective contents of *auch* ‘too’ and *wieder* again’. These results suggest that the content of the complement of *wissen* ‘know’ is more at-issue than the content of the complement of *erfahren* ‘find out’, which in turn are comparatively more at-issue than the relevant contents of *auch* ‘too’ and *wieder* again’. Interestingly, comparing the relative projectivity and not-at-issueness of the contents across their two experiments, Xue and Onea (2011:180) point to “a clear correlation between projection and not-at-issueness”, in line with the proposal made by Simons et al. 2010. Our Experiments 1a and 1b improve on Xue and Onea’s (2011) study by exploring the projectivity and the not-at-issueness of projective content as within-item and within-participant factors. This experiment design allows us to quantify the influence of not-at-issueness on the projectivity of utterance content but also to assess item- and participant-variability. Since different diagnostics have been used in the literature to diagnose (not-)at-issueness (for discussion, see, e.g., Tonhauser 2012 and section 2), the second pair of experiments, Experiments 2a and 2b, explore the not-at-issueness of the contents of the first pair of experiments, Experiments 1a and 1b, using a different diagnostic for at-issueness. The results of the two pairs of experiments thus also allow for a comparison of two diagnostics for at-issueness.

The paper proceeds as follows. In section 2, we characterize the projective contents explored in this paper. Section 3 addresses the two goals of the paper on the basis of Experiments 1a and 1b, and section 4 extends our investigation of the second goal on the basis of Experiments 2a and 2b. In section 4, we discuss the implications of our findings for conventionalist and Simons et al.’s (2010) approaches to projection and projection variability.

2 The projective contents explored in the experiments

This section introduces properties of the projective contents explored in the two pairs of experiments. These projective contents are contributed by 19 expressions, henceforth referred to as ‘triggers’, but without making any commitment to these expressions conventionally specifying the projectivity of the relevant content.

The 9 projective content triggers included in Experiment 1a are syntactically heterogeneous, as shown in (7), whereas the 12 triggers included in Experiment 1b are all attitude predicates, as shown in (8). Experiments 2a and 2b explored not-at-issueness for the same trigger/projective content pairs³ as Experiments 1a and 1b, respectively. Since the projective content of the attitude predicates *annoyed* and *discover* was explored in both pairs of experiments, 19 trigger/projective content pairs were explored in total.

(7) Trigger/projective content pairs in Experiments 1a and 2a

1. Sentence-medial non-restrictive relative clauses / content of the NRRC
e.g., *Martha, who has a new BMW, drives fast*; content: ‘Martha has a new BMW’
2. Sentence-medial nominal appositives / appositive content
e.g., *Martha’s new car, a BMW, was expensive*; content: ‘Martha has a BMW’
3. Possessive noun phrases / possession implication
e.g., *Martha’s new car is a BMW*; possession implication: ‘Martha has a new car’
4. *annoyed* / content of the clausal complement
e.g., *Martha’s neighbor was annoyed that Martha has a new BMW*; content: ‘Martha has a

³Since some expressions, like clefts or definite noun phrases, can contribute multiple projective contents (Tonhauser et al. 2013), we specify, for each trigger, the projective content investigated in our experiments.

- new BMW'
5. *discover* / content of the clausal complement
e.g., *Mary discovered that her daughter has been biting her nails*; content: 'Mary's daughter has been biting her nails'
 6. *know* / content of the clausal complement
e.g., *Billy knows that Martha has a new BMW*; content: 'Martha has a new BMW'
 7. *only* / prejacent
e.g., *Martha only likes blueberries*; prejacent: 'Martha likes blueberries'
 8. *stop* / pre-state implication
e.g., *Martha stopped smoking*; pre-state implication: 'Martha smoked in the past'
 9. *stupid* / prejacent
e.g., *Martha was stupid to buy that TV*; prejacent: Martha bought that TV

(8) **Trigger/projective content pairs in Experiments 1b and 2b**

1. *be amused* / content of the clausal complement
2. *be annoyed* / content of the clausal complement
3. *know* / content of the clausal complement
4. *be aware* / content of the clausal complement
5. *see* / content of the clausal complement
6. *discover* / content of the clausal complement
7. *find out* / content of the clausal complement
8. *realize* / content of the clausal complement
9. *learn* / content of the clausal complement
10. *establish* / content of the clausal complement
11. *confess* / content of the clausal complement
12. *reveal* / content of the clausal complement

In what follows, we characterize the properties of the 19 trigger/projective content pairs explored in the experiments.

Projectivity The 19 projective contents share the property of being projective, i.e., being able to be taken to be a commitment of the speaker. The 9 projective contents in Experiments 1a and 2a differ in how robustly they (have been reported to) project: the content of non-restrictive relative clauses, nominal appositives and of the emotive 'factive' predicate *annoyed* are typically taken to project more robustly than, e.g., the prejacent of *only*, the pre-state implication of *stop* and the complement of the cognitive 'semi-factive' predicate *discover* (e.g., Karttunen 1971; Simons 2001; Potts 2005; Abusch 2010; Beaver 2010). The 12 triggers included in Experiments 1b and 2b include both 'factive' and 'semi-factive' predicates, which, as discussed in the introduction, are assumed to differ in how robustly the content of their complement projects. The predicates were also chosen to denote different types of attitudes: emotive 'factive' predicates (*be amused*, *be annoyed*), cognitive 'factive' predicates (*know*, *be aware*), sensory 'factivities' predicates (*see*), cognitive 'semi-factives' predicates (*discover*, *find out*, *realize*, *learn*, *establish*) and communication 'semi-factives' (*confess*, *reveal*). The predicates *be annoyed* and *discover* were included in both Experiments 1a and 1b (and 2a and 2b) to be able to directly compare the results of the experiments.

Strong Contextual Felicity A property shared by the 19 trigger/projective content pairs is that they do not impose a Strong Contextual Felicity constraint (Tonhauser et al. 2013). What this means is that utterances with the triggers included in the experiments are judged to be acceptable in contexts in which the projective

content is not already part of the common ground of the interlocutors when the trigger is uttered. B's utterance in (5b), for instance, is acceptable even if A did not previously know the content of the non-restrictive relative clause, that Mike visited Alcatraz.⁴ A trigger/projective content pair that is associated with a Strong Contextual Felicity constraint is the pronoun *they* and the projective content that there is a uniquely salient plurality of individuals (to which the pronoun refers). Use of *they* in (9) is judged to be unacceptable because the projective content of the pronoun is not part of the common ground of the interlocutors, i.e., the context does not entail the existence of a uniquely salient plurality of individuals to which the pronoun could refer.

- (9) Context: At a bus stop in San Francisco, a woman approaches another woman, with no other people are around, and asks:
#Did they visit Alcatraz?

Including only trigger/projective content pairs not associated with a Strong Contextual Felicity constraint in the experiments was motivated by our goal of exploring the relative projectivity and not-at-issueness of the triggers. It is well-known that the context in which a projective content trigger occurs influences whether the projective content projects (see, e.g., the examples in (4), but also, e.g., Simons 2001; Beaver 2010). In our experiments, all of the projective content triggers were therefore presented in the same, minimal contexts: contexts that clarify the situation in which the trigger is uttered but that does not contain information that might influence the extent to which the projective content is projective or not-at-issue. Including trigger/projective content pairs associated with a Strong Contextual Felicity constraint would have forced us to present the triggers in different contexts, thereby hampering cross-trigger comparisons.⁵

Obligatory Local Effect The 19 trigger/projective content pairs differ in whether they have Obligatory Local Effect (Tonhauser et al. 2013), the property that distinguishes trigger/projective content pairs based on whether the projective content is obligatorily contributed to an attitude holder's belief state when the trigger occurs in the complement of a belief-predicate. The examples in (10) illustrate that the content of non-restrictive relative clauses does not have Obligatory Local Effect, in contrast to the content of the complement of *discover*, which does. In (10a), where the non-restrictive relative clause occurs in the complement clause of *believe*, the attitude holder (Sarah) need not be committed to the content of the non-restrictive relative clause, that Mike visited Alcatraz, as shown by the acceptability of the continuation (*... but she doesn't know that Mike has already visited Alcatraz*). In contrast, in (10b), where *discover* occurs in the complement of the belief-predicate, Sarah must be committed to the same content (that Mike visited Alcatraz), as shown by the unacceptability of the same continuation.

- (10) a. Sarah believes that Mike, who visited Alcatraz, is interested in the history of prisons, ... but she doesn't know that Mike has already visited Alcatraz.
b. Sarah believes that Felipe discovered that Mike visited Alcatraz, ... #but she doesn't know that Mike has already visited Alcatraz.

In addition to the projective content of non-restrictive relative clauses, the projective contents of appositives and of possessive noun phrases do not have Obligatory Local Effect. The remaining 16 trigger/projective content pairs, including that of *discover*, have Obligatory Local Effect.

Thus, the 9 projective content triggers explored in Experiments 1a and 2a are syntactically heterogeneous, have been reported to differ in how robustly the projective content projects and include 3 that have

⁴In fact, Potts 2005 even argues that the content of non-restrictive relative clauses is typically required to be new information.

⁵As discussed in section 3, the minimal contexts in which the stimuli were presented also have the property of not plausibly licensing 'local accommodation' (Heim 1983; van der Sandt 1992), the process that allows conventionalist approaches to projection to account for projective content not projecting.

Obligatory Local Effect and 6 that don't. The 12 projective content triggers explored in Experiments 1b and 2b, on the other hand, are attitude predicates, i.e. syntactically comparatively homogenous, and all have Obligatory Local Effect, though they differ in how robustly their projective contents (have been reported to) project.

3 Experiments 1a and 1b

Experiments 1a and 1b were designed to empirically explore the projectivity of the 19 projective contents, to better understand projection variability (the first goal of the paper) and to test Simons et al.'s (2010) proposal that the projectivity of utterance content is influenced by at-issueness, i.e., the information-structural status of such content (the second goal of the paper).

To best examine the influence of at-issueness on projectivity, we collected, for each stimulus, judgments about both the projectivity and the at-issueness of the relevant projective content. Consider, for instance, Patrick's polar question with the nominal appositive in (11). The relevant projective content here is that Martha's new car is a BMW. The 'certain that' response question in (11a) assesses the extent to which Patrick is taken to be committed to the projective content, i.e., the extent to which the content projects from Patrick's polar question. The 'asking whether' response question in (11b) assesses the extent to which Patrick is asking about the projective content, i.e., the extent to which the projective content is at-issue in Patrick's polar question.

- (11) Patrick asks: *Was Martha's new car, a BMW, expensive?*
- a. 'certain that' question: Is Patrick certain that Martha's new car is a BMW?
 - b. 'asking whether' question: Is Patrick asking whether Martha's new car is a BMW?

Thus, in Experiments 1a and 1b, the entailment-canceling environment in which the projective content triggers were embedded were polar questions. This choice of embedding was motivated by the availability of a diagnostic for at-issueness for polar questions. For earlier uses of this diagnostic for at-issueness see, e.g., Amaral et al. 2007:731 and Tonhauser 2012.

3.1 Experiment 1a

Experiment 1a was designed to explore the projectivity and at-issueness of the 9 projective contents in (7).

3.1.1 Methods

Materials. The 9 projective contents explored in this experiment were instantiated by 17 contents, which are shown in (12) together with the label used to refer to the content.

- (12) 17 contents used in Experiments 1a and 2a
- 1. muffins: these muffins have blueberries in them
 - 2. pizza: this pizza has mushrooms on it
 - 3. play: Jack was playing outside with the kids
 - 4. vegetarian: Don is a vegetarian
 - 5. cheat: Raul cheated on his wife
 - 6. nails: Mary's daughter has been biting her nails
 - 7. ballet: Ann used to dance ballet
 - 8. kids: John's kids were in the garage
 - 9. hat: Samantha has a new hat

10. bmw: Martha has a new BMW
11. boyfriend: Betsy has a boyfriend
12. alcatraz: Mike visited Alcatraz
13. aunt: Janet has a sick aunt
14. cupcakes: Marissa brought the cupcakes
15. soccer: the soccer ball has a hole in it
16. olives: this bread has olives in it
17. stuntman: Richie is a stuntman

Each of the 9 projective contents was instantiated by 3 to 8 of these 17 contents, as shown in Table 1, for a total of 3-8 target stimuli per projective content trigger. ('NRRC' abbreviates 'non-restrictive relative clause', 'NomApp' abbreviates 'nominal appositive' and 'possNP' abbreviates 'possessive noun phrase'.) As discussed in section 1, different projective contents were instantiated by the same contents (e.g., the content 'muffins' instantiates the projective content of non-restrictive relative clauses and *only*) to increase cross-trigger comparability. As shown in Table 1, each content instantiated between 2 and 4 projective contents.

content	Projective content triggers								
	NRRC	NomApp	possNP	discover	know	annoyed	stop	only	stupid
muffins	✓							✓	
kids								✓	✓
pizza				✓		✓		✓	
play				✓	✓		✓		
nails				✓			✓		✓
ballet		✓					✓		
cheat					✓				✓
stuntman		✓							✓
bmw		✓	✓		✓	✓			
vegetarian	✓	✓							
hat			✓		✓	✓			
boyfriend	✓		✓						
aunt	✓		✓		✓				
alcatraz	✓			✓	✓				
soccer	✓			✓	✓	✓			
olives						✓			
cupcakes	✓				✓				

Table 1: Contents instantiating the projective contents of the 9 triggers in Experiments 1a and 2a

The target stimuli were polar questions, like those in (13), where the content 'stuntman' instantiates the projective contents of a nominal appositive and of *stupid*:

- (13) a. Did Richie, a stuntman, break his leg?
- b. Is Richie stupid to be a stuntman?

The experiment also included 17 control stimuli, which were polar questions formed from the 17 contents in (12). The control stimulus formed from the content 'stuntman' is shown in (14). The 17 control

stimuli were included to confront the participants with contents that are neither projective nor at-issue, and to assess whether participants were attending to the task. The full set of stimuli is provided in Appendix A.

(14) Is Richie a stuntman?

For each participant, a set of 15 polar question stimuli was randomly created: each set contained a target polar question for each of the 9 projective content triggers paired with a unique content and 6 control polar questions, each again paired with a unique content. Each participants' 15 polar question stimuli were presented twice: once (in a random order) in the 'certain that' block and once (in a random order) in the 'asking whether' block. In the 'certain that' block, participants answered 'certain that' response question (assessing projection) and, in the 'asking whether' block, participants answered a 'asking whether' response question (assessing at-issueness), as shown in (11), repeated below for convenience. Block order was random across the participants.

(11) Patrick asks: *Was Martha's new car, a BMW, expensive?*

- a. 'certain that' question: Is Patrick certain that Martha's new car is a BMW?
- b. 'asking whether' question: Is Patrick asking whether Martha's new car is a BMW?

Procedure. Participants were told to imagine that they are at a party and that, upon walking into the kitchen, they overhear somebody ask another person a question. Participants were then presented with their 15 polar question stimuli, either the 'certain that' or in the 'asking whether' block, and then with their 15 polar question stimuli again, in the other block. On each trial, participants read the polar question stimulus as well as the corresponding response question, and then gave their response on a slider marked 'no' at one end and 'yes' at the other, as shown in Figure 1.

Michelle asks: "*Does Billy know that Martha has a new BMW?*"

Is Michelle asking whether Martha has a new BMW?

no yes

Next

Figure 1: A sample (at-issueness) trial in experiment 1a

A 'yes' (1) response to 'certain that' questions was taken to indicate that the person who uttered the polar question (e.g., Michelle in the sample trial) was committed to the relevant content, i.e., that the content projects, whereas a 'no' (0) response was taken to indicate that the content did not project. For the 'asking whether' questions, a 'yes' (0) response was taken to indicate that the speaker was asking about the relevant content, i.e., that it was at-issue, whereas a 'no' (1) response was taken to indicate that the content was not at-issue.

After responding to their 30 polar question stimuli, participants completed a short survey about their age, their native language(s) and, if English is their native language, whether they are a speaker of American English (as opposed to, e.g., Australian or Indian English). To encourage them to respond truthfully, participants were told that they would be paid no matter what answers they gave in the survey.

Participants. 250 participants with U.S. IP addresses and at least 97% of previous HITs approved were recruited on Amazon’s Mechanical Turk platform (ages: 18-74; median: 32). They were paid \$1 for participating in the experiment.

3.1.2 Results

In this section, we first address what the experimental findings show about projection variability and then turn to Simons et al.’s (2010) hypothesis that projectivity is influenced by at-issueness.

Prior to analysis, the data from 29 participants who did not self-identify as native speakers of American English were excluded. Inspection of the response means of the remaining 221 participants to the ‘certain that’ and ‘asking whether’ questions for the control polar questions revealed 11 participants whose response means were more than 3 standard deviations above the group means (which were 0.07 for ‘certain that’ and 0.04 for ‘asking whether’ questions). Closer inspection revealed that these participants’ responses to the control polar questions were systematically higher than the group means and involved 16 of the 17 contents, suggesting that these participants did not attend to the task or interpreted the task differently. The data from these 11 participants were also excluded, leaving data from 210 participants (ages 19-68; median: 33).

Projection variability Box plot showing projection variability:

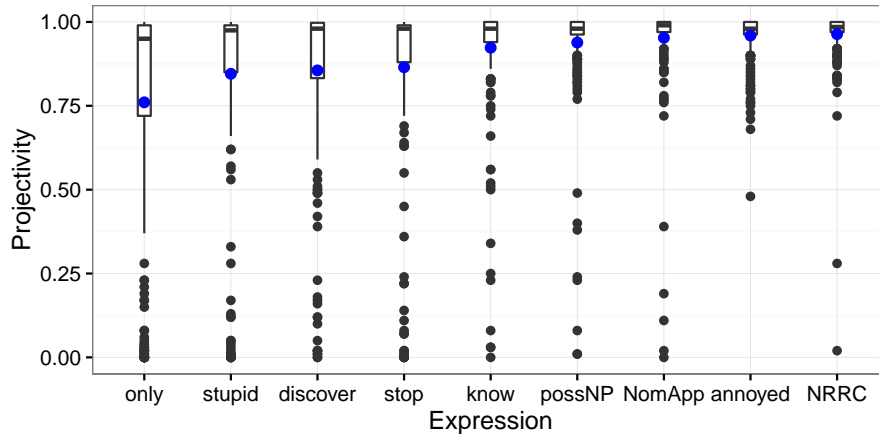


Figure 2: Projection variability

The influence of at-issueness on projectivity The relation between not-at-issueness and projectivity

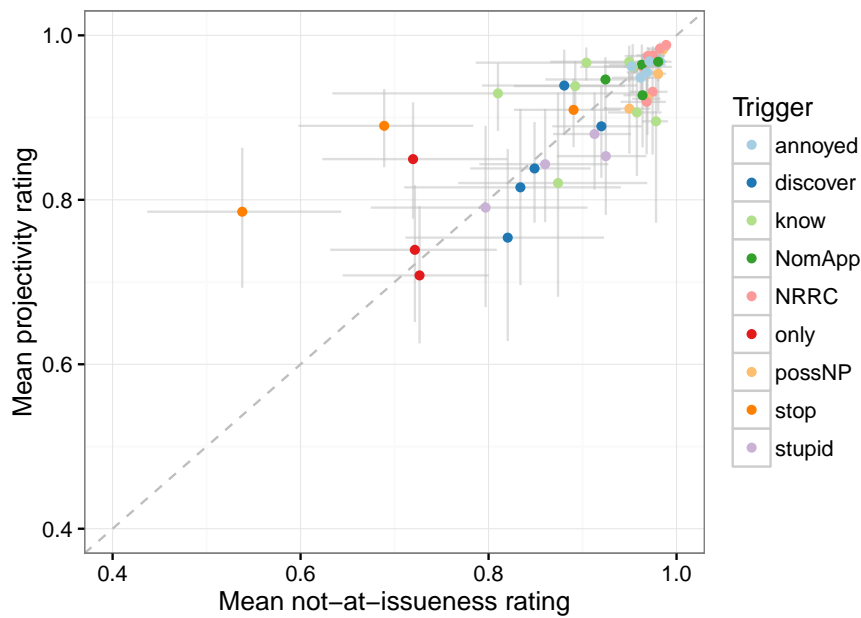


Figure 3: Projectivity by not-at-issueness by trigger – not content?

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The boxplots in Figure 4 illustrate the projectivity and not-at-issueness of the nine expression/content pairs in the top and bottom panels, respectively. In both panels, the expression/content pairs are ordered by their mean (given by the blue dots), with the expression/content pairs with the lowest projectivity and not-at-issueness on the left.

JD: Interesting that in general, the variability appears to be in the response variance, not the response medians.

Order effects. Of the remaining 210 participants, 116 first responded to ‘asking whether’ questions and 94 first responded to ‘certain that’ questions about their set of 15 polar questions. To examine whether question order had an effect on participants’ responses, linear mixed-effects models predicting the responses to the ‘asking whether’ and ‘certain that’ questions from the trigger and question order **JD: You mean with just random by-participant and by-content intercepts?** with random effects for participant and projective content were fit to the data. Question order was not a significant predictor for responses to ‘certain that’ questions, suggesting that projectivity judgments were not influenced by whether participants had previously responded to ‘asking whether’ questions. Question order was, however, a significant predictor for responses to ‘asking whether’ questions, with responses significantly higher when participants responded to ‘asking whether’ questions after they had responded to ‘certain that’ questions ($\beta=0.05$, $SE=0.02$, $t=3.31$, $p < 0.01$). **JD: Why are there multiple analyses investigating order effects? Why not just include order as a predictor in the main model you report?** A linear mixed-effects model predicting response to ‘asking whether’ questions from the trigger and question order, and their interaction, and random effects for participant and projective content revealed that the effect was carried solely by responses to polar questions with *only*: responses to ‘asking whether’ questions about the prejacent of *only* were significantly higher when those questions followed ‘certain that’ questions about the prejacent (mean response: .83) than when those questions preceded ‘certain that’ questions about the prejacent (mean response: .64).

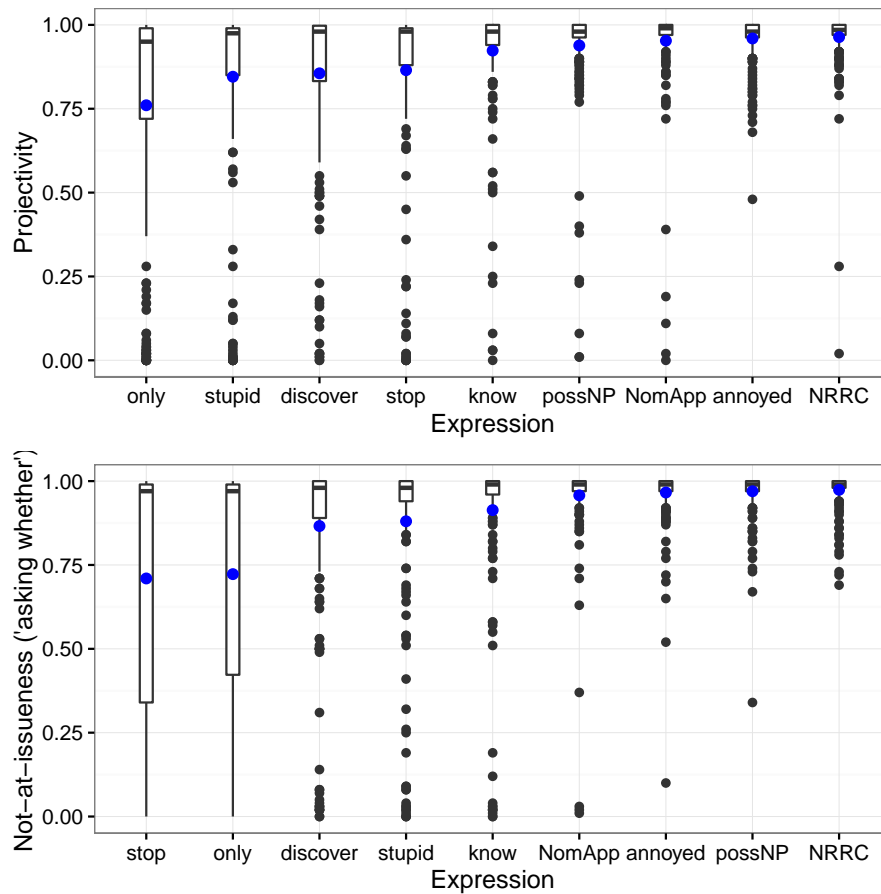


Figure 4: Boxplots of the responses to the ‘certain that’ (top panel) and ‘asking whether’ (bottom panel) questions for the nine expressions contributing projective content; the blue dots show the mean responses

- The nine contents received relatively high responses to both the ‘certain that’ and ‘asking whether’ questions, in line with the assumption that these contents are projective and not-at-issue.

```
proj.1 <- lmer(projective ~ short_trigger * ai + (1+ai|workerid) + (1|content), data=t)
```

shows that all projective contents are significantly different from main clauses in projectivity (fuller model did not converge)

```
nai.1 <- lmer(ai ~ short_trigger + (1|workerid) + (1|content), data=t)
```

shows that all projective contents are significantly different from main clauses in not-at-issueness (model with slope did not converge)

- There is variability in the projectivity of the nine contents.

```
comp_proj.2 <- glht(proj.1, mcp(short_trigger="Tukey"))
summary(comp_proj.2)
```

discover, only, stupid < annoyed

discover < know, NomApp, NRRC

discover < possNP (marginal)

```
stop < discover
only, stupid < know, possNP
only, stupid < NomApp, NRRC
only < stop
stupid < stop
```

- There is variability in the not-at-issueness of the nine contents.

```
comp_nai <- glht(nai.1, mcp(short_trigger="Tukey"))
summary(comp_nai)
only, stop, stupid, discover < annoyed
discover < NomApp, NRRC, possNP
only, stop < discover
know < NRRC (marginal)
only < know
know < possNP (marginal)
stop < know
only, stop < NomApp
only, stop, stupid < NRRC
only, stop, stupid < possNP
only, stop < stupid
```

- Correlation between projectivity and not-at-issueness

- Projectivity and not-at-issueness appear correlated since the relative order of expressions in the two panels is similar.
- A picture of the correlation (by mean projectivity and not-at-issueness)
- Not-at-issueness is a significant predictor of projectivity:

```
proj.2 <- lmer(projective ~ short_trigger + ai + (1+ai|workerid) + (1|content),
data=t)
summary(proj.2)
anova(proj.1,proj.2)
proj.1 is significantly better fit than proj.2
```

3.1.3 Discussion

- or by being conventionally contributed to a separate dimension of meaning (e.g., Karttunen and Peters 1979; Potts 2005)
- By contrast, ‘non-conventionalist’ approaches attempt to derive projectivity from independently-motivated properties of the meanings of the expressions that contribute projective content, such as *discover*, and their use in context (e.g., Stalnaker 1974; Wilson 1975; Simons 2001, 2004; Abusch 2010; Abrusán 2011; Simons et al. 2017). Atlas 2005, Boër & Lycan 1976, Chierchia and McConnell-Ginet 1990, Kadmon 2001, Kempson 1975, Levinson 1983.

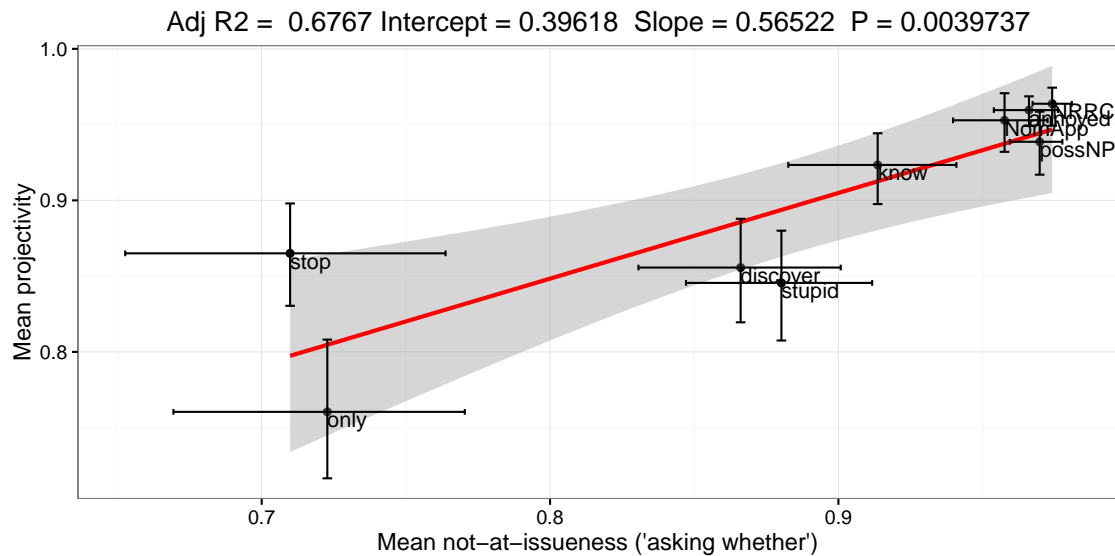


Figure 5: Correlation between mean not-at-issueness and mean projectivity for the nine projective content triggers in Experiment 1a

- Because we have minimal contexts: no local accommodation!

Given these intuitions about projection variability, different ways forward are imaginable. One way would be to rely on the process of ‘local accommodation’, by which projective content can be accommodated in the scope of entailment-canceling operators, e.g., to avoid contradictions, un informativity or problems with binding (Heim 1983; van der Sandt 1992), and to argue that some projective content, like that of *win*, *announce* or *discover*, can more readily be locally accommodated than, e.g., the projective content of clefts or *regret*. This way forward, however, is contingent on a better understanding of local accommodation and the question of why some but not all projective content seems to resist local accommodation. (For relevant discussion see, e.g., Beaver and Zeevat 2007.)

- Another way forward is to assume that some projective content is not conventionally specified to project, and therefore projects less robustly and in context-dependent ways (see, e.g., Simons 2001; Abusch 2010; Abrusán 2011; Simons et al. 2017).
- some contents show much less variability than others
- Syrett and Koev 2015 show that NRRCs and nominal appositives differ in at-issueness depending on position. We only had sentence-medial NRRCs and nominal appositives, but they were more not-at-issue on our diagnostic than on their diagnostic.

3.2 Experiment 1b

Why are we looking at factives now? Would be helpful to foreshadow at end of intro

Experiment 1b was designed to explore projection variability and the hypothesis in (??) with a range of factive predicates. The twelve predicates were selected to include a variety of different factive predicates, including emotive ones (*be amused*, *be annoyed*), cognitive factives (*know??*, *be aware*), sensory factives (*see*), cognitive semi-factives (*discover*, *find out*, *realize*, *learn*, *establish*), communication semi-factives (*confess*, *reveal*).

3.2.1 Methods

Participants. 250 participants with U.S. IP addresses and at least 97% of previous HITs approved were recruited on Amazon’s Mechanical Turk platform. They were paid \$1 for participating in the experiment.

Materials. The target stimuli were (past and present tense) polar questions formed from sentences with one of the twelve clause-embedding predicates in (15a), one of the twenty clausal complements in (15b) and a proper name subject (the names used for the subjects did not occur in the clausal complements).

(15) a. **Clause-embedding predicates:** *be amused, be annoyed, be aware, confess, discover, establish, find out, learn, notice, realize, reveal, see*

b. **Clausal complements:**

- | | |
|--|---|
| 1. Raul was drinking chamomile tea | 11. Carl wrote a poem for his wife |
| 2. Jack played frisbee with the kids | 12. Bea posted a family picture on Facebook |
| 3. John was hiding in the garage | 13. Janet moved into a damp apartment |
| 4. Mike visited the zoo | 14. Samantha bought a fur hat |
| 5. Zach dyed his hair purple | 15. Don ate a chili dog |
| 6. Marissa brought almond cupcakes | 16. Mary was biting her nails |
| 7. Chad put up a swing in his backyard | 17. Richie jumped into the pool |
| 8. Greg drove his car into a ditch | 18. Martha came in her new BMW |
| 9. Kate fell from her horse | 19. Ann was dancing in the corner |
| 10. Joyce got a poodle | 20. Sue was doing yoga in the yard |

An additional 20 control polar questions were formed from main clauses conveying the 20 contents in (15b). For each participant, a set of 20 polar question stimuli was randomly created from 20 distinct projective contents so that each set included 12 polar questions formed with the 12 clause-embedding verbs and eight control polar questions.

Procedure. The procedure of Experiment 1b was the same as for Experiment 1a, described in section 3.1.1, except that participants responded to 20 ‘certain that’ and 20 ‘asking whether’ questions.

JD: Again, I would switch order of Materials and Procedure. Add a sentence about why there are now more trials.

3.2.2 Analysis

The data from 3 participants who did not self-identify as native speakers of American English were excluded. As with Exp 1a, the responses to the ‘asking whether’ questions were recoded so that a ‘yes’ (1) response means that the relevant content is not at-issue.

Responses to control polar questions. Inspection of the response means of the remaining 247 participants to the ‘certain that’ and ‘asking whether’ questions for the control polar questions revealed 12 participants whose response means were more than 3 standard deviations above the group means (the group means were 0.08 for ‘certain that’ and 0.04 for ‘asking whether’ questions). Further inspection revealed that these participants’ responses to the control questions were systematically higher than the group means and involved all of the 20 projective contents, suggesting that these participants did not attend to the task or interpreted the task differently. The data from these 12 participants were also excluded, leaving data from 235 participants (ages 18-74; median: 33).

Order effects. Of the remaining 235 participants, 120 first responded to ‘asking whether’ questions and 115 first responded to ‘certain that’ questions about their set of 20 polar questions. To examine whether question order had an effect on participants’ responses, linear mixed-effects models predicting the responses to the ‘asking whether’ and ‘certain that’ questions from the trigger and question order with random effects for participant and projective content were fit to the data. Question order was not a significant predictor for responses to ‘certain that’ or ‘asking whether’ questions, suggesting that projectivity and not-at-issueness judgments were not influenced by whether participants had previously responded to ‘asking whether’ and ‘certain that’ questions, respectively.

3.2.3 Results

The boxplots in Figure 6 illustrate the projectivity and not-at-issueness of the contents of the complements of the twelve attitude predicates in the top and bottom panels, respectively. In both panels, the attitude predicates are ordered by their mean projectivity and not-at-issueness (given by the blue dots), with the attitude predicates whose contents had the lowest projectivity and not-at-issueness on the left.

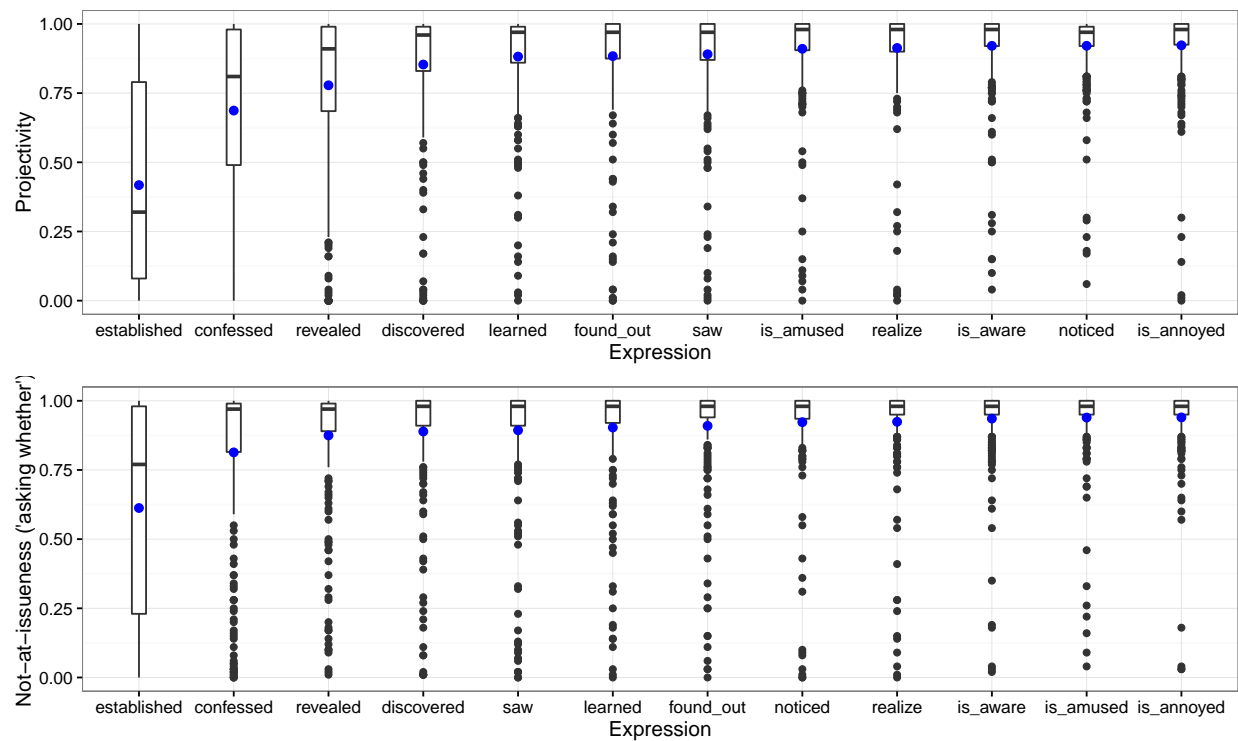


Figure 6: Boxplots of the responses to the ‘certain that’ (top panel) and ‘asking whether’ (bottom panel) questions for the twelve clause-embedding predicates; the blue dots show the mean responses

- The nine contents received relatively high responses to both the ‘certain that’ and ‘asking whether’ questions, in line with the assumption that these contents are projective and not-at-issue.

All verbal complement contents significant different from main clauses in projectivity and not-at-issueness

- There is variability in projectivity (comp_proj.2)

established < confessed < revealed < discovered, amused, saw, found out, learned
 < annoyed, aware, noticed

discovered < realize (marginal)

- There is variability in not-at-issueness (comp_nai)

established < confessed < revealed < is amused, is annoyed, is aware

discovered < is amused, is annoyed

saw < is amused, is annoyed (both marginal)
- Correlation between projectivity and not-at-issueness
 - Projectivity and not-at-issueness appear correlated since the relative order of expressions in the two panels is similar.
 - A picture of the correlation (by mean projectivity and not-at-issueness)

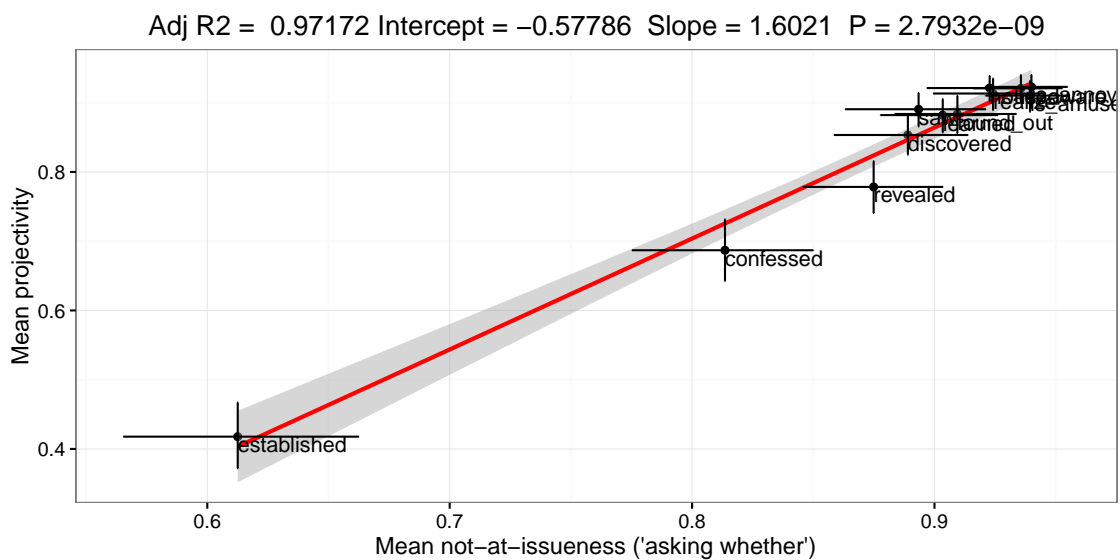


Figure 7: Correlation between mean not-at-issueness and mean projectivity for the twelve factive predicates in Experiment 1b

- Not-at-issueness is a significant predictor of projectivity.

3.2.4 Discussion

4 Confirming the correlation with information structure

The two experiments discussed in this section, Experiments 2a and 2b, explore the not-at-issueness of the relevant projective contents explored in Experiments 1a and 1b, respectively, using a different diagnostic for not-at-issueness. In particular, this second not-at-issueness diagnostic relies on the assumption that at-issue content can be the target of an *Are you sure (about that)?* question. (For uses of related diagnostics see, e.g., Tonhauser 2012.) In this diagnostic, the expressions contributing the relevant (projective) contents are not embedded under entailment-canceling operators. The diagnostic is illustrated for the appositive content of nominal appositives and the content of the complement of *know* in (16a) and (16b), respectively. In both examples, person A utters a sentence in which the relevant expression contributes the relevant content and person B response with *Are you sure?*. A's subsequent response realizes the content to be diagnosed as the content of the complement of *sure*.

- (16) A: Marthas new car, a BMW, was expensive.
B: Are you sure?
A: Yes, I am sure that Martha's new car is a BMW.
- (17) A: Billy knows that Martha has a new BMW.
B: Are you sure?
A: Yes, I am sure that Martha's new car is a BMW.

To experimentally diagnose whether B's utterance can be taken to target the relevant (projective) content, participants were asked whether A is responding to B's question, with the assumption that participants will take A to have responded to B's question if the relevant content can be at-issue, i.e., can be taken to be the target of B's question, and participants will take A to not have responded to B's question if the relevant content cannot be at-issue, i.e., cannot be taken to be the target of B's question.

4.1 Experiment 2a

Experiment 2a explored the not-at-issueness of the same expression/content pairs explored in Experiment 1a, using the *Are you sure?* diagnostic.

4.1.1 Methods

Participants. 250 participants with U.S. IP addresses and at least 97% of previous HITs approved were recruited on Amazon's Mechanical Turk platform. They were paid 30 cents for their participation.

Materials. The target stimuli in this experiment consisted of 3-turn discourses between two individuals, as illustrated in (16). The same nine trigger/content pairs as in Experiment 1a (see (??)) were realized with the same 3-8 (projective) contents, yielding a total of 43 indicative sentences, which were realized as the first individual's first utterance. In contrast to Experiment 1a, the target stimuli in this experiment were indicative sentences in which the triggers were not embedded under an entailment canceling operator, as illustrated for nominal appositives and *know* in A's first utterances in (16). The second turn of the stimuli consisted of a different person uttering *Are you sure?*. The third turn consisted of the first person uttering *Yes, I am sure that*, with the relevant content realized as the content of the complement of *sure*. As in Experiment 1a, an additional 17 control stimuli were formed from the 17 contents: here, person A uttered a main clause conveying such a content (e.g., *A: Martha has a new BMW. B: Are you sure? A: Yes, I am sure that Martha has a new BMW.*).

As in Experiment 1a, a set of 15 stimuli was randomly created for each participant from 15 distinct contents so that each set included nine stimuli formed with the nine trigger/content pairs and six control stimuli.

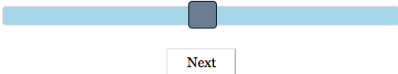
Procedure. Participants were told to imagine that they are at a party and, upon walking into the kitchen, overhear a short conversation between two people. Participants were then read their 15 stimuli in random order and were asked to assess, for each stimulus, whether person A answered person B's question (e.g., *Did Ralph answer Susi's question?*). They gave their responses on a slider marked 'no' at one end and 'yes' at the other, as shown in Figure ?? above. A 'yes' (1) response was taken to indicate that person B could be taken to ask about the relevant content, i.e., that the content was at-issue, whereas a 'no' (0) response was taken to indicate that person B could not be taken to ask about the relevant content, i.e., that the content was not at-issue. After responding to the 15 stimuli, participants completed the same survey as in Experiment 1a.

Participants read the polar question stimuli as well as the corresponding questions and gave their responses on a slider marked 'no' at one end and 'yes' at the other, as shown in Figure 8.

Amy: "Martha's neighbor is annoyed that Martha has a new BMW."
Dennis: "Are you sure?"
Amy: "Yes, I'm sure that Martha has a new BMW."

Did Amy answer Dennis's question?

no yes



Next

Figure 8: A sample trial in experiments 2a and 2b

4.1.2 Analysis

The data from 6 participants who did not self-identify as native speakers of American English were excluded. As with Exps 1a and 2a, participants' responses were recoded so that a 'yes' (1) response means that the relevant content is not at-issue.

Responses to control stimuli. Inspection of the response means of the remaining 244 participants to six main clause control stimuli revealed 6 participants whose response means were more than 3 standard deviations above the group mean (which was 0.04). Further inspection revealed that these participants' responses to the control questions were systematically higher than the group means and involved 14 of the 17 projective contents, suggesting that these participants did not attend to the task or interpreted the task differently. The data from these 6 participants were also excluded, leaving data from 238 participants (ages 20-77; median: 30).

4.1.3 Results

The boxplots in Figure 9 illustrate the not-at-issueness of the nine expression/content pairs, which are again ordered by their mean (given by the blue dots), with the expression/content pairs with the lowest not-at-issueness on the left.

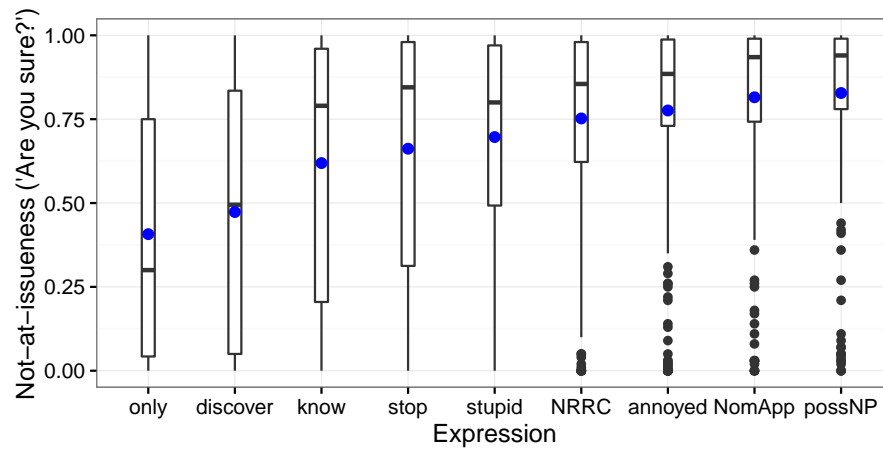


Figure 9: Boxplots of responses to nine expression/content pairs in *Are you sure?*-diagnostic; the blue dots show the mean responses

- `nai.1` shows that all contents significantly more NAI than main clauses
- `comp_nai` shows that significant differences among contents
only, stop, stupid, discover, know < annoyed
discover < know, NomApp, NRRC, possNP
stop, stupid < discover
stupid, only < know < NomApp, NRRC, possNP
only, stop, stupid < NomApp
only, possNP, stop < NRRC
only < possNP, only, stupid
stop, stupid < possNP
- Correlation of the two not-at-issueness diagnostics:
- Correlation of projectivity with the new not-at-issueness diagnostic:

4.1.4 Discussion

4.2 Experiment 2b

4.2.1 Methods

Participants. 250 participants with U.S. IP addresses and at least 97% of previous HITs approved were recruited on Amazon’s Mechanical Turk platform. They were paid 30 cents for their participation.

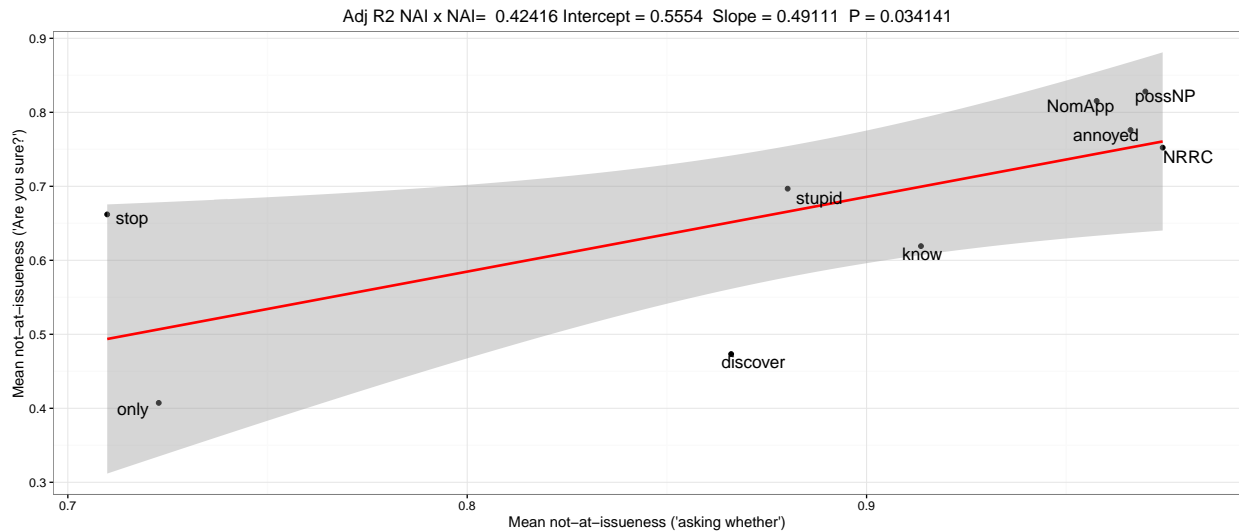


Figure 10: Correlation of the means of the two not-at-issueness diagnostics (Experiments 1a and 2a)

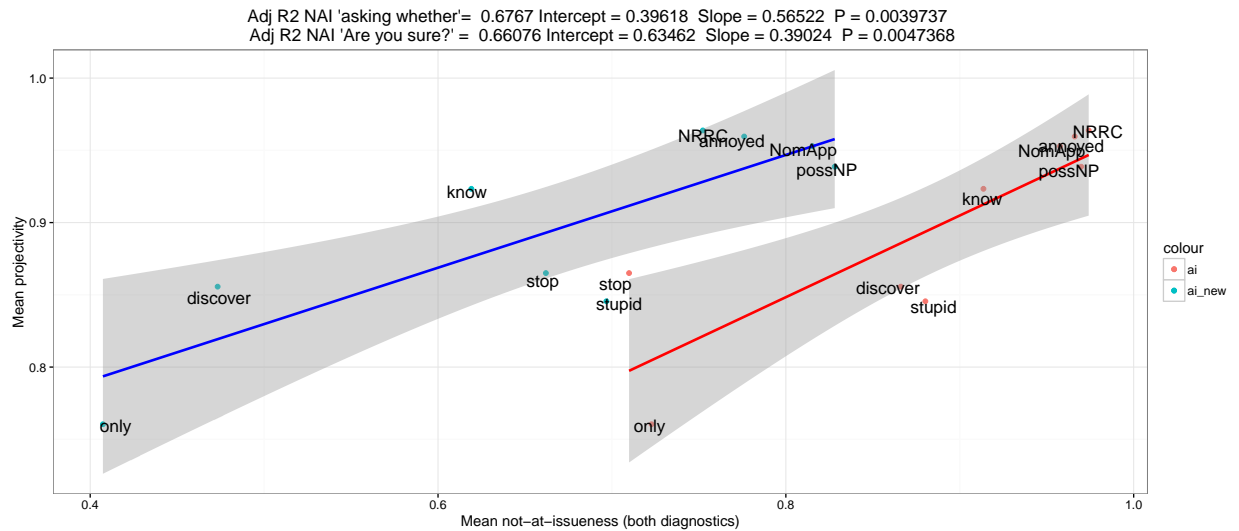


Figure 11: Correlation of the mean projectivity with the two not-at-issueness diagnostics (Experiments 1a and 2a)

Materials. The target stimuli in this experiment consisted of 3-turn discourses between two individuals, as illustrated in (16). The same twelve trigger/content pairs as in Experiment 1b (see (15)) were realized with the same 20 contents, yielding a total of 240 indicative sentences, which were realized as the first individual's first utterance. In contrast to Experiment 1b, the target stimuli in this experiment were indicative sentences in which the triggers were not embedded under an entailment canceling operator, as illustrated for nominal appositives and *know* in A's first utterances in (16). The second turn of the stimuli consisted of a different person uttering *Are you sure?*. The third turn consisted of the first person uttering *Yes, I am sure that*, with the relevant content realized as the content of the complement of *sure*. As in Experiment 1b, an additional 20 control stimuli were formed from the 20 contents: here, person A uttered a main clause conveying such

a content (e.g., A: *Raul was drinking chamomile tea.* B: *Are you sure?* A: *Yes, I am sure that Raul was drinking chamomile tea.*).

As in Experiment 1b, a set of 20 stimuli was randomly created for each participant from 20 distinct contents so that each set included twelve stimuli formed with the twelve attitude predicates and eight control stimuli.

Procedure. The procedure was the same as in experiment 2a, described in section 4.1.1, except that participants responded to 20 stimuli (rather than just 15).

4.2.2 Analysis

The data from 6 participants who did not self-identify as native speakers of American English were excluded. As with the previous experiments, participants' responses were recoded so that a 'yes' (1) response means that the relevant content is not at-issue.

Responses to control stimuli. Inspection of the response means of the remaining 244 participants to eight main clause control stimuli revealed 6 participants whose response means were more than 3 standard deviations above the group mean (which was 0.05). Further inspection revealed that these participants' responses to the control questions were systematically higher than the group means and involved 18 of the 20 contents, suggesting that these participants did not attend to the task or interpreted the task differently. The data from these 6 participants were also excluded, leaving data from 238 participants (ages 18-77; median: 30).

4.2.3 Results

The boxplots in Figure 12 illustrate the not-at-issueness of the contents of the complements of the twelve factive predicates, which are again ordered by their mean (given by the blue dots), with the factive predicate whose complement was least not-at-issue on the left.

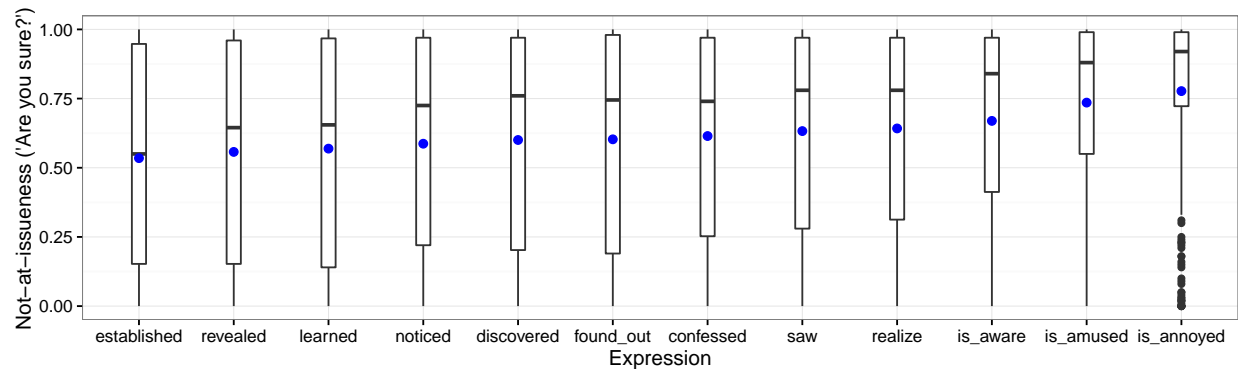


Figure 12: Boxplots of responses to the contents of the complements of the twelve attitude predicates in *Are you sure?*-diagnostic; the blue dots show the mean responses

Correlation of projectivity with the new not-at-issueness diagnostic:

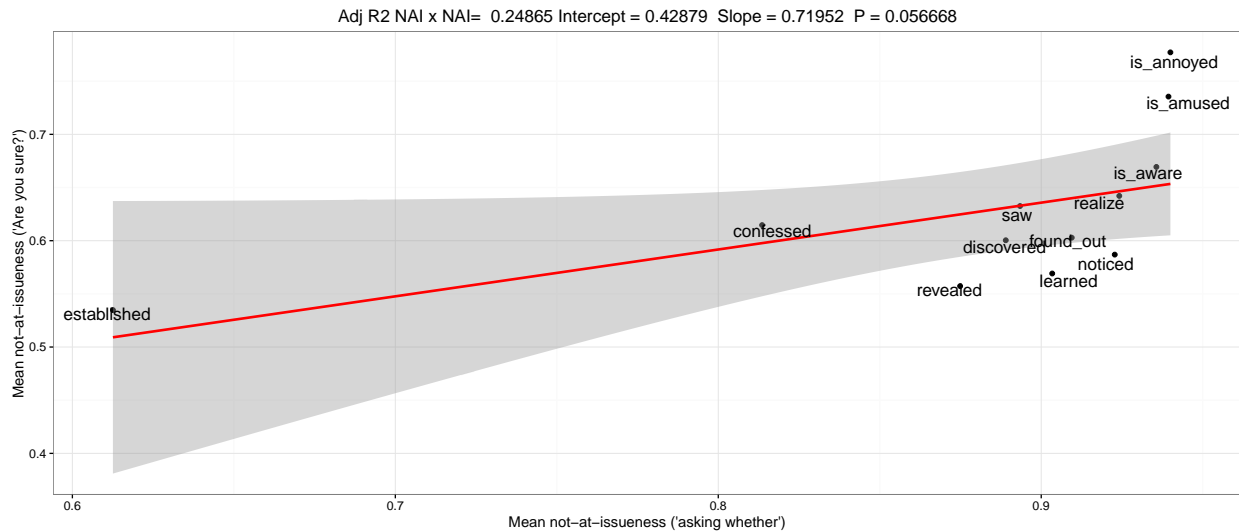


Figure 13: Correlation of the means of the two not-at-issueness diagnostics (Experiments 1b and 2b)

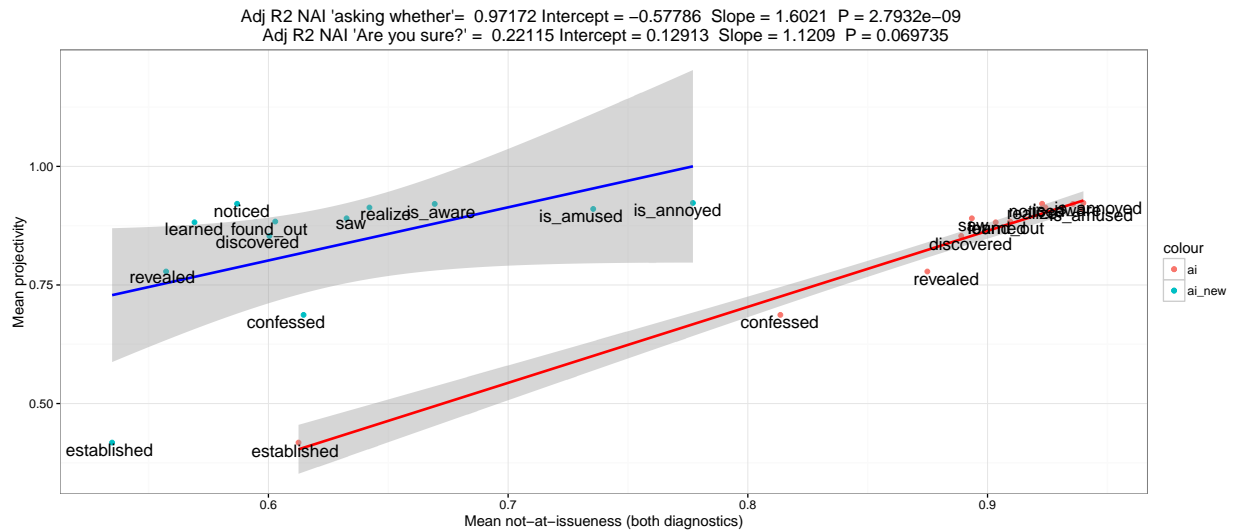


Figure 14: Correlation of the mean projectivity with the two not-at-issueness diagnostics (Experiments 1b and 2b)

4.2.4 Discussion

5 Discussion

- Other refs on ps: Schwarz 2007; Chemla 2009; Tiemann et al. 2011. Zeevat 1992 distinguishes resolution and lexical triggers based on whether they can be globally accommodated; see Amaral and Cummins 2015 for experimental investigation of that difference.
- These experimental findings provide empirical support for Simons et al's projection hypothesis. Furthermore, they constitute a problem for accommodation-based theories of presupposition projection:

since the minimal discourse context in which the stimuli in Exp 1a were presented does not license local accommodation, such theories wrongly predict robust presupposition projection, i.e., cannot account for the observed projection variability.

A Experiment 1a/2a stimuli

The polar questions used in Experiment 1a are given below grouped by the content that constituted the projective content. This also makes it possible to see which trigger/content pairs had overlap with which other ones. Experiment 2a used main clause versions of these polar questions.

1. "muffins":
Content: "these muffins have blueberries in them",
"MC": "Do these muffins have blueberries in them?",
"NRRC": "Are these muffins, which have blueberries in them, gluten-free and low-fat?",
"only": "Do these muffins only have blueberries in them?"
2. "pizza":
Content: "this pizza has mushrooms on it",
"MC": "Does this pizza have mushrooms on it?",
"only": "Does this pizza only have mushrooms on it?",
"annoyed": "Is Sam annoyed that this pizza has mushrooms on it?",
"discover": "Did Sam discover that this pizza has mushrooms on it?"
3. "play":
Content: "Jack was playing outside with the kids",
"MC": "Was Jack playing outside with the kids?",
"stop": "Did Jack stop playing outside with the kids?",
"know": "Does Daria know that Jack was playing outside with the kids?",
"discover": "Did Paula discover that Jack was playing outside with the kids?"
4. "veggie":
Content: "Don is a vegetarian",
"NomApp": "Is Don, a vegetarian, going to find something to eat here?",
"NRRC": "Is Don, who is a vegetarian, going to find something to eat here?",
"MC": "Is Don a vegetarian?"
5. "cheat":
Content: "Raul cheated on his wife",
"MC": "Did Raul cheat on his wife?",
"know": "Does Daria know that Raul cheated on his wife?",
"stupid": "Was Raul stupid to cheat on his wife?"
6. "nails":
Content: "Mary's daughter has been biting her nails",
"MC": "Has Mary's daughter been biting her nails?",
"discover": "Did Mary discover that her daughter has been biting her nails?",
"stop": "Has Mary's daughter stopped biting her nails?",
"stupid": "Is Mary's daughter stupid to be biting her nails?"

7. "ballet":
 Content:"Ann used to dance ballet",
 "MC": "Did Ann use to dance ballet?",
 "NomApp": "Is Ann, a former ballet dancer, limping?",
 "stop": "Did Ann stop dancing ballet?"
8. "kids":
 Content:"John's kids were in the garage",
 "only": "Were John's kids only in the garage?",
 "MC": "Were John's kids in the garage?",
 "stupid": "Were John's kids stupid to be in the garage?"
9. "hat":
 Content:"Samantha has a new hat",
 "MC": "Does Samantha have a new hat?",
 "possNP": "Was Samantha's new hat expensive?",
 "know": "Does Daria know that Samantha has a new hat?",
 "annoyed": "Is Joyce annoyed that Samantha has a new hat?"
10. "bmw":
 Content:"Martha has a new BMW",
 "MC": "Does Martha have a new BMW?",
 "possNP": "Was Martha's new BMW expensive?",
 "NomApp": "Was Martha's new car, a BMW, expensive?",
 "annoyed": "Is Martha's neighbor annoyed that Martha has a new BMW?",
 "know": "Does Billy know that Martha has a new BMW?"
11. "boyfriend":
 Content:"Betsy has a boyfriend",
 "MC": "Does Betsy have a boyfriend?",
 "NRRC": "Is Betsy, who has a boyfriend, flirting with the neighbor?",
 "possNP": "Is Betsy's boyfriend from around here?"
12. "alcatraz":
 Content:"Mike visited Alcatraz",
 "MC": "Did Mike visit Alcatraz?",
 "NRRC": "Is Mike, who visited Alcatraz, a history fan?",
 "discover": "Did Jane discover that Mike visited Alcatraz?",
 "know": "Does Jane know that Mike visited Alcatraz?"
13. "aunt":
 Content:"Janet has a sick aunt",
 "MC": "Does Janet have a sick aunt?",
 "NRRC": "Is Janet, who has a sick aunt, very compassionate?",
 "know": "Does Melissa know that Janet has a sick aunt?",
 "possNP": "Has Janet's sick aunt been recovering?"
14. "cupcakes":
 Content:"Marissa brought the cupcakes",
 "MC": "Did Marissa bring the cupcakes?",

"NRRC": "Is Marissa, who brought the cupcakes, a good baker?",
"know": "Does Max know that Marissa brought the cupcakes?",

15. "soccer":

Content: "the soccer ball has a hole in it",
"MC": "Does the soccer ball have a hole in it?",
"NRRC": "Was the soccer ball, which has a hole in it, a gift from Uncle Bill?",
"annoyed": "Is Mandy annoyed that the soccer ball has a hole in it?",
"discover": "Did Mandy discover that the soccer ball has a hole in it?",
"know": "Does Mandy know that the soccer ball has a hole in it?"

16. "olives":

Content: "this bread has olives in it",
"MC": "Does this bread have olives in it?",
"annoyed": "Is Barbara annoyed that this bread has olives in it?",

17. "stuntman":

Content: "Richie is a stuntman",
"MC": "Is Richie a stuntman?",
"NomApp": "Did Richie, a stuntman, break his leg?",
"stupid": "Is Richie stupid to be a stuntman?"

References

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