Does at-issueness predict projection? Further investigations of the Gradient Projection Principle

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Abstract

Tonhauser et al. 2018 hypothesized that at-issueness is one factor that modulates the projection of content (see also Simons et al. 2010, Beaver et al. 2017). Specifically, according to their Gradient Projection Principle, if content C is expressed by a constituent embedded under an entailment-canceling operator, then C projects to the extent that it is not at-issue. Their work provided evidence for the GPP from xx contents that had been described as projective in the literature, at-issueness was measured in two different ways, only one consistently brought evidence in support (question, asking whether, are you sure? mixed results 2b). This paper provides further investigate the GPP by investigating a) more varied items, b) with more types of embedding, and c) other measures of at-issueness. These experiments provide additional support for the GPP, and they also show: comparison of projection across entailment-canceling operators, comparison of at-issueness diagnostics. Suggests that the diagnostics may not all measure the same (Snider 2017b).

1 Introduction

(1) Context: A and B live near a dog that regularly barks for extended periods of time. It is barking right now. A says:
Ugh. The damn dog is barking again.

Contents:

- there is a unique salient dog (backgrounded, ps)

- the dog has barked before (backgrounded, ps)

- the speaker is annoyed at the dog/barking (new, could be what the speaker wants to contribute)

- the dog is barking ("at-issue", ordinary entailment)

First dimension: Role in discourse context: some anchor to context, some convey relevant backgrounded information, some are what the speaker wants to communicate.

Second dimension: Compositional semantics: some interact, some don't.

Third dimension: Role in subsequent discourse: some are what carries the conversation on, some do not.

One of the contents is privileged in that it is the content that is put up for negotiation. It is often new information, though not necessarily. It is what is "linguistically relevant": it interacts with operators and is accessible for anaphoric reference.

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(2) **Gradient Projection Principle** (Tonhauser et al. 2018:400)
   If content *C* is expressed by a constituent embedded under an entailment-canceling operator, then *C* projects to the extent that it is not at-issue.

   We already know that the GPP is stated too strongly: prior influences projection (Degen and Tonhauser 2021) **independently of at-issueness (unpublished)**. At-issueness is one factor among many.

(3) **Main research question**
   Are not-at-issueness and projection positively correlated, as predicted by the Gradient Projection Principle?

(4) **Ancillary research questions**
   a. Is the at-issueness of contents embedded under different entailment-canceling operators positively correlated?
   b. Is the at-issueness of contents positively correlated under different measures of at-issueness?

   Previous investigations of/claims about the relationship between projection and at-issueness:

   - Simons et al. 2010, Beaver et al. 2017

   - Xue and Onea 2011

   - Tonhauser et al. 2018

   - Koev 2018

   Limited how? (only presuppositions + CCs of factive predicates: Degen and Tonhauser in print / few measures of at-issueness / some supporting results, some not / some embedded, other matrix clause)

(5) 20 clause-embedding predicates
   a. canonically factive: *be annoyed, discover, know, reveal, see*
   b. nonfactive:
      i. nonveridical nonfactive: *pretend, suggest, say, think*
      ii. veridical nonfactive: *be right, demonstrate*
   c. optionally factive: *acknowledge, admit, announce, confess, confirm, establish, hear, inform, prove*

2 Analyzing and diagnosing at-issueness

2.1 Formal analyses of at-issueness

- Esipova, Maria. 2018. QUD-addressing appositives don?t have to be clause-final. Snippets 33. 7?8. https://doi.org/10.7358/snip-2018-033-esip.
   - Djrv, Kajsa. 2019. Factive and assertive attitude reports. Philadelphia, PA: Uni- versity of Pennsylvania dissertation. https://repository.upenn.edu/edissertations/ 3645.
   backgrounded content

(6) Formal analyses of at-issueness

a. Dimension-based
   At-issue content interacts with operators

b. Question-based
   At-issue content addresses the question under discussion

c. Anaphora-based
   At-issue content introduces a discourse referent for subsequent reference

- Potts 2005

  - p.23/Figure 2.1: at-issue entailments vs. backgrounded content (conventional presuppositions, CIs, conversationally-triggered presuppositions) vs. conversational implicatures (not backgrounded!!) **3-way distinction**

  - p.24: But the supplementary relative who lived in a working-class suburb of Boston plays a secondary role relative to the information conveyed by the main clause. The issue is not where the grandmother lived, but rather the fact that the speaker summered with her as a child.

  - p.30: the utterance might be followed in the discourse by ?Hey, she?ll do both!? Or it might be preceded by an agreement that if Mary does one, then she does the other. The maxims of quality and quantity would then conspire to en- sure that (2.35b) disappeared. Thus, the conversational-implicature dimension is a negotiable part of denotations.

  - p.31: a CI is never relativized to the beliefs of an entity other than the speaker. But at-issue content certainly is; in Sue wrongly believes Conner got promoted, the at-issue proposition that Conner got promoted is asserted to hold only in Sue?s belief worlds. this embedded proposition is not speaker-oriented, and hence not classifiable as a CI contri- bution,

  - p.32: CIs are independent of the at-issue con- tent. In contrast, the fundamental goal of almost all presupposition logics is to create a dependency between the presuppositions and the at-issue entailments

  - p.34: Neither at- issue content nor CI content should be presupposed.

  - p.43: everything about the definition says that CIs contribute new information. In this sense, they are like at-issue content.

  - **can we diagnose not-at-issue content independent of a particular type of not-at-issue con- tent? that is, is there a diagnostic for not-at-issueness that applies to all such content, regardless of its specific type?**

  - p.51: discourse-level phenomena. It seems that none are sensitive to the distinction between these two types of content. (at-issue vs CI): VP ellipsis and do it/that pronominalization

  - p.53: Overall, they are an indication that we distinguish the at-issue and CI dimensions in the composition. From the point of view of a discourse as a whole, they are identical.

  - p.54: A similar, and less fraught, test involves discourse referents. Because noth- ing can scope over supplementary CI content, it is quite good at establishing discourse referents. ... Here again, presupposed material patterns differently. It alone cannot establish a discourse referent, at least not without a significant amount of contextual priming and some creative inferences on the part of the hearer;

  - p.54: Speaker-oriented adverbs, for instance, suggest a new test. Exam- ples (3.16)?(3.17) show that their content can be queried just as at-issue content can.

- p.54: The upshot of these examples is that CI content is model-theoretically the same as at-issue content. ... Thus, we are led to the con- clusion that the distinction exists only at the level of the meaning language. **potts assumes that ai and nai content are not distinct on a discourse level!**

- p.70: in the CI logic employed here, translation is a nontrivial step, as it is the locus of the at-issue/CI distinction. If we interpreted natural language expres- sions directly, we would be left with only two options, both undesirable: we could locate the distinction in the natural language syntax or in the models. The syntactic view is initially unpromising given the semantic nature of the defini- tion of CIs, and it receives sustained criticism in chapter 6. The model-theoretic option is to locate the differences in the models. But section 3.3 shows that in- tersentential phenomena treat the two classes of meaning as model-theoretically identical. Moreover, it is hard to see what the distinctions could be.

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  - p.666: "typically the content that speakers offer as primary and also the content that they are most expecting to have to negotiate with their interlocutors before it is accepted into the common ground"

- Koev 2013, 2018, 2021

  - Koev 2018

    * p.1: At-issue content is that part of the sentence meaning that is intuitively felt to express the ?main point? when the sentence is uttered in a given context. Potts (2005; 2007) was among the first to use the term ?at-issue content? in the relevant sense, characterizing it as content that ?carr[ies] the main themes of a discourse? (Potts, 2005, 7), and that speakers are ?most expect- ing to have to negotiate with their interlocutors before it is accepted into the common ground? (Potts, 2007, 666). The first property, i.e. the ability to contribute to the discourse topic, is often expressed by saying that at-issue content is what is relevant to the question under discussion. The second property, i.e. the ability to represent what is being negotiated among interlocu- tors, is typically captured by saying that at-issue content constitutes a proposal to update the common ground.

    * p.2: There exist several empirical tests for at-issueness, e.g. question/answer pairs and accessibility to direct denials or other discourse continuations. Exist- ing accounts have employed such tests rather indiscriminately or without elaborating on how these tests relate to a given theoretical construal. In order to be able to judge a given theory on its own merits, in each case I will consider only those diagnostics that transparently follow from what counts as at issue in the relevant sense.

    * p.3: q-at-issueness: A proposition p is Q-atissue relative to a question under discussion Q and a context c iff ? p is relevant to Q in c and ? p is appropriately conventionally marked relative to Q.

    * p.4: Above, Q-at-issueness was diagnosed in question/answer pairs. This is consistent with the question-based definition in 2, provided that an overt question is assumed to manifest the current question under discussion.

    * p.5: several authors identify at-issue content with the proposal introduced by a declarative utterance, i.e. with its asserted content (AnderBois et al., 2015; Farkas & Bruce, 2010; Koev, 2013; Murray, 2014; Potts, 2005). **potts 2005 does not assume that CIs are not asserted!**

* p.5: A proposition p is P-at-issue in a context c iff ? p is a proposal in c and ? p has not been accepted or rejected in c.

* p.5: to test a proposition for proposalhood, we need a lin- guistic tool that tracks what is being negotiated at any given point. One widely used diagnostic to this effect is the assent/dissent test, which probes the amenability of semantic content to direct responses

* p.6: This test brings up the question of what counts as a direct response. One peculiar- ity about the responses in 10?11 is that they are anaphoric to parts of the target utterance through propositional anaphors like that or no.7 This is important because nonanaphoric de- nials behave differently: They can felicitously target nominal appositives (see also Hunter & Asher, 2016).

* p.6: One possible reaction to the contrast in 10?11 v. 12?13 is to say that the assent/dissent test tracks anaphoric potential rather than P-at-issueness. This is reasonable, although it has also been claimed that P-at-issue content obligatorily establishes a propositional discourse referent (Murray, 2014).

* p.6: I will thus follow the bulk of the literature in assuming that such responses target the assertion and will employ them as the main diagnostic for P-at-issueness, leaving the precise link between anaphoricity and at-issueness to further research.

* p.7: A third notion of at-issueness is situated within theories which view discourse as struc- tured by coherence relations, also called ?rhetorical? or ?discourse? relations (Asher & Lascarides, 2003; Hobbs, 1979, 1985; Kehler, 2002; Mann & Thompson, 1988).

* p.8: A proposition expressed by a node ?? of a discourse tree D is C-atissue iff ?? is on the right frontier of D.

* p.8: A proposition is C-atissue iff a freshly uttered segment can attach to it by some appro- priate coherence relation.

* p.9: Coherence-based accounts thus view the assent/dissent test as a special case of dis- course attachment, i.e. one in which the response is connected to the target by an Agree- ment/Denial relation.

* p.9: Q-at-issueness is primarily a backward-looking notion or relates to existing discourse. By contrast, P-at-issueness and C-at-issueness are forward-looking or relate to what is to come.

* p.10: I first compare Q-at-issueness and P-at-issueness, arguing that neither property entails the other.

* p.10: Koev argues that 26 shows that the appositive is not P-at-issue but that 27 shows that it is Q-at-issue: "appositive relative clauses are often taken into consideration when an- swering the question under discussion. Here, the crucial information that Mary experienced firsthand the terrible consequences of cancer comes from the appositive; the main clause alone does not answer the question, at least not without loss of information."
(26) A: Mary took care of her husband, who had prostate cancer, for almost a year. B: ? No, he didn't.
(27) Q: Why is Mary fundraising for the upcoming Walk For Cancer? A: She took care of her husband, who had prostate cancer, for almost a year.

* p.10: Relevance implicatures. They are not P-at-issue (as diagnosed by dissent) but Q-at- issue (as diagnosed by Q/A pairs).

* p.10f: slifting constructions. Can be P-at-issue (dissented with) but don't answer Q (diag- nosed by Q/A pairs)

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* p.11: Simons et al. (2010) and Beaver et al. (2017) claim that projectivity is perfectly correlated with (the lack of) Q-at-issueness **NOT TRUE**.

* p.12: The Projection Principle then appears to be problematic in both directions: Projecting content can be Q-at issue, and nonprojecting content can be not Q-at issue. **Need to engage with Koev 2018 as somebody who doesn't believe in the GPP**

* p.12: The second observation is that the Projection Principle is stated in terms of Q-at-issueness **NO!** and other notions of at-issueness may lead to different predictions. The question of which notion of at-issueness (if any) makes the right predictions about projection is yet to be systematically investigated.

* endnote 1: I also limit my attention to declarative sentences. The question of how or whether at-issueness interacts with other sentence types will have to await another study.

* endnote 5: The assent/dissent test is known under different names in the literature and has been used to distinguish asserted content from implications triggered by constructions as different as presupposition markers (Chierchia & McConnell-Ginet, 2000; Karttunen & Peters, 1979; Shanon, 1976; Strawson, 1950), epistemic modals (Lyons, 1977; Papafragou, 2006; von Fintel & Gillies, 2007), evidentials (Faller, 2002; Matthewson et al., 2007; Murray, 2014), and appositives (AnderBois et al., 2015; Koev, 2013; Syrett & Koev, 2015; Tonhauser, 2012).

* endnote 16: Appositive content typically projects, so it could be argued that it is not ?intended? as being at issue (see Simons et al., 2010). However, given its significance in the above context and the fact that conventional marking of at-issueness is often overruled, the information that the director fired Jon would very likely be taken into consideration when answering the question under discussion.

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- Korotkova 2020

- Murray 2014

- AnderBois et al. 2015

- Snider 2017a

- Snider 2017b (superseded for the most part by 2018 paper)

  - In this paper, I argue that there is no tight link between at-issueness and anaphoric availability? that these two properties of propositions are distinct. I present data which demonstrates that a proposition?s at-issue status alone is not sufficient to determine whether it will be available for anaphoric reference (including but not limited to direct assent/dissent), as well as data which shows that a proposition?s being available for anaphoric reference cannot be used to diagnose its at-issue status.

  - Tonhauser asserts that they are all indeed testing for at-issueness: ?they are all useful to diagnose (not-)at-issueness with at least one kind of content? (p. 252). **I was wrong**

  - p.6: The question/answer tests return the same results, because their use of anaphors (response particles) is only incidental. In contrast, the direct dissent tests rely on explicit anaphors by design; an anaphor-less equivalent to the direct dissent test in (11) ceases to be the same diagnostic.

- Snider 2018

    - p.374: at-issueness and the anaphoric potential of a proposition are distinct notions; one class of tests commonly used to diagnose at-issue status in fact diagnoses only anaphoric potential

    - NRRCs: anaphoric potential varies, especially with position, but never good to address question under discussion

    - at-issue content: certain content conveyed by an utterance has a distinguished status as the main point of the utterance, while other content does not. Potts 2005 discusses ?at-issue entailments? as distinct from presuppositions and conventional implicatures, but does not describe how to identify content as at-issue.

    - p.375: Properties of at-issue content (from Tonhauser 2012)

        At-issue content can be directly assented or dissented with **third dimension**

        At-issue content addresses the question under discussion **first dimension**

        At-issue content determines the relevant set of alternatives **second dimension, compositionality**

        Some content may overlap on all three dimensions: e.g., that Fritz is happy in *Fritz is happy*. But sentence-final appositives can be assented/dissented with, but they do not address the QUD or determine the relevant set of alternatives. And that the speaker is annoyed may address the QUD, but does not determine the relevant set of alternatives.

    - p.376f: Snider argues against Syrett and Koev 2015 claim that appositives can address the QUD. "Why questions are crucially different from these other questions in that they seek explanations. Because they seek explanations, such questions have no single comprehensive answer: any answer given is defeasible2 or can be considered insufficiently precise, and additional contextual information can always contribute to an explanation (see discussion in Bjorndahl & Snider, 2016). The appositive might contribute information which bolsters an explanation, supporting the matrix clause?s answer to the QUD, but that alone does not constitute addressing the QUD. If the matrix clause does not address the QUD, then an appositive alone cannot be taken to address the QUD, even in a why question, as in (7)"

        Syrett & Koev 2015:587 further points to an example where an appositive appears to ?address one part of a coordinated QUD?, inspired by an example from Koev 2013. But the concept of a ?coordinated QUD? is novel: Roberts 1996 describes no such structure, instead describing sequences of ?relevant sub-questions to some super-question? as an ?enumeration, suggesting a plan for how to attack the super-question?, and says that one ?can only address such sub-questions one at a time? (5). The response in (8A) thus addresses the first sub-question?as it must, because the second requires an answer to the first?and not both at once.

    - p.378: The crucial difference between the classes of diagnostics illustrated above is that the first is anaphora-based, where the other two are QUD-based, as they test what can address or establish a Question Under Discussion.

        Snider assumes that the two QUD diagnostics (addressing QUD, establishing QUD) are QUD-based, i.e., tap into the same property? But establishing a QUD is about compositionality, and addressing a QUD is about the role of content in discourse.

    - p.380: Alternatively, this observation might lead one to move away from the Simons et al. 2010 definition entirely. Hunter & Asher 2016 proposes a discourse based account using SDRT (Asher, 1993; Asher & Lascarides, 2003) in which at-issueness and anaphoric potential are indeed closely linked?which isn?t at odds with the data discussed here, because they use an entirely different notion of at-issueness. On this account, ?content is at-issue at a certain point of

the discourse just in case it is on the [Right Frontier (RF)] of the discourse at that time. Content that is AI becomes NAI when knocked off the RF; content that is NAI can become AI if targeted through discourse subordination? and thus returned to the Right Frontier (Hunter & Asher, 2016:1036). And, because discourse referents (propositional and otherwise) are only accessible for anaphora resolution in SDRT if they are on the Right Frontier, propositional content which is available for anaphoric reference is necessarily at-issue on this account.

– p.380: However one chooses to define or model at-issueness, it is important to recognize the difference between the at-issue status of a proposition and its anaphoric potential. The two are at least conceptually distinct: at-issueness is about what the main point of an utterance is, while anaphoric potential is about what propositions are available for subsequent anaphoric reference.

- Syrett and Koev 2015

- Tonhauser 2012

- Simons et al. 2010

- Tonhauser et al. 2018

- Beaver et al. 2017

2.2 Diagnosing at-issueness

- Diagnostics for at-issueness are either suitable for polar questions or for declaratives.

  – Polar questions: at-issue content partitions the context set
  'asking whether'
  'yes, c'
  'yes, but not-c"
  – Declaratives: at-issue content is the target of anaphora
  'sure that'
  'yes, that's true, c'
  'yes, that's true, but not-c"

2.3 Next steps

3 Experiments 1-3: Methods

Exps. 1-3 were designed to investigate whether not-at-issueness and projection are positively correlated, as predicted by the Gradient Projection Principle, as well as to compare various measures of at-issueness.[1]

To measure projection, Exps. 1-3 employed the 'certain that' diagnostic for projection, which is suitable to measure projection for both polar questions and declarative sentences (see also, e.g. Tonhauser 2016, Djärv and Bacovcin 2017, Stevens et al. 2017, Lorson 2018, Tonhauser et al. 2018, Mahler 2019, 2020, de Marneffe et al. 2019).[2] On this diagnostic, participants are presented with an utterance, like one of the

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[1]The experiments, data, and R code for generating the figures and analyses of the experiments reported in this paper are available at `https://github.com/judith-tonhauser/projective-probability`. All experiments were conducted with IRB approval. Exps. 1b, 2b, and 3b were preregistered: `https://osf.io/cxq47`.

[2]For other diagnostics for projection see, e.g. Smith and Hall 2011, Xue and Onea 2011, and Tonhauser et al. 2013; see also the discussion in Tonhauser et al. 2018.

utterances in (7), in which the content to be diagnosed for projection (here, that Julian dances salsa) occurs embedded under an entailment-canceling operator:

(7) 'certain that' diagnostic for projection
  a. Daniel: Did Cole discover that Julian dances salsa?
  b. Daniel: Cole didn't discover that Julian dances salsa.
  c. Daniel: Perhaps Cole discovered that Julian dances salsa.
  d. Daniel: If Cole discovered that Julian dances salsa, Logan will be joyful.

To assess projection, participants are asked whether the speaker is certain of the content; for instance, in 7, participants are asked whether Daniel is certain that Julian dances salsa. If a participant takes the speaker to be certain of the content, we assume that the content projects; if a participant does not take the speaker to be certain of the content, we assume that the content does not project. Following Tonhauser et al. 2018, the 'certain that' diagnostic was implemented in Exps. 1-3 with a gradient response scale: participants gave their responses on a slider marked 'no' at one end and 'yes' at the other. We assume that the closer to 'yes' a participant's response is, the more the speaker is certain of the content, that is, the more projective the content is. In other words, we assume that gradient certainty ratings reflect gradience in the speaker's commitment to the truth of the content.[3] As discussed in Tonhauser et al. 2018, a second interpretation of gradient certainty ratings is that they reflect a participant's degree of belief in the speaker's (binary) commitment to the truth of the content. While we adopt the first interpretation in our discussion, we remain agnostic about the interpretation of gradient certainty ratings.

At-issueness was measured with different diagnostics across Exps. 1-3. For polar questions (Exps. 1q, 2q, 3q), at-issueness was assessed with the three measures in (8):

(8) At-issueness diagnostics for polar questions
  a. 'asking whether c'
   Christopher: Did Cole discover that Julian dances salsa?
   Is Christopher asking whether Julian dances salsa?
  b. *yes*, c
   Christopher: Did Cole discover that Julian dances salsa?
   Sandy: Yes, Julian dances salsa.
   Does Sandy's response to Christoper sound good?
  c. *yes, but ¬c'*
   Christopher: Did Cole discover that Julian dances salsa?
   Sandy: Yes, but Cole didn't discover it.
   Does Sandy's response to Christoper sound good?

For declaratives, at-issueness was assessed with the three measures in (9):

(9) At-issueness diagnostics for declaratives
  a. 'sure that c'
   Christopher: Cole didn't discover that Julian dances salsa.
       Perhaps Cole discovered that Julian dances salsa.
   Sandy: Are you sure?
   Christopher: Yes, I'm sure that Julian dances salsa.
   Did Christopher answer Sandy's question?

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[3]Strictly speaking, gradient certainty ratings reflect gradience in the degree to which participants *perceive* the speaker to be committed to the truth of the content. That is, as in any experiment, the quantity of interest, in this case speaker commitment, is only indirectly measured.

b. *yes, that's true, c*
   Christopher: Cole didn't discover that Julian dances salsa.
   Sandy: Yes, that's true, Julian dances salsa.
   Does Sandy's response to Christopher sound good?

c. *yes, that's true, but ¬c′*
   Christopher: Cole didn't discover that Julian dances salsa.
   Sandy: Yes, that's true, but Cole discovered it.
   Does Sandy's response to Christopher sound good?

Exp.	Embedding	Projection measure	At-issueness measure
1q	question	certain that c	asking whether c
1n	negation	certain that c	sure that c
1m	modal	certain that c	sure that c
1c	conditional	certain that c	sure that c
2q	question	certain that c	*yes*, c
2n	negation	certain that c	*yes, that's true*, c
2m	modal	certain that c	*yes, that's true*, c
2c	conditional	certain that c	*yes, that's true*, c
3q	question	certain that c	*yes*, but ¬$c′$
3n	negation	certain that c	*yes, that's true*, but ¬$c′$
3m	modal	certain that c	*yes, that's true*, but ¬$c′$
3c	conditional	certain that c	*yes, that's true*, but ¬$c′$

Table 1: Overview of the entailment-canceling embeddings, projection measures, and at-issueness measures in Exps. 1-3, where c is the content under investigation (in the target trials: the content of the clausal complement) and $c′$ is a different, salient content (in the target trials: the main clause content).

Comparisons for at-issueness:

- Across Exps 1q, 2q, 3q (same assumption about at-issue content partitioning context set; reveals effect of embedding)

- Across Exps n, m, c (same measure of at-issueness in Exps 1, 2, 3; reveals effect of embedding)

- 2q – 2n, 2m, 2c (yes...c; i.e., anaphor with c)

- 3q – 3n, 3m, 3c (yes...but ¬c, i.e., anaphor with c)

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3.1   Participants

We recruited 250-300 participants for each of Exps. 1-3. Participants for Exp. 1q were recruited on Amazon's Mechanical Turk platform; the participants were required to have U.S. IP addresses and at least 99% of previously approved HITs. Participants for the remaining experiments were recruited on Prolific; these participants were required to reside in the US, to be born in the US, to have English as their first language,

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[4]Exps. 1-3 also allow us to address the question of whether the projection of contents embedded under different entailment-canceling operators is positively correlated, as assumed in the semantics/pragmatics literature (e.g., REFERENCES). Prior experimental literature: Smith and Hall 2011, 2014, de Marneffe et al. 2019. As shown in Supplement F, this is the case.

and to have an approval rating of at least 99%. Information on recruited participants (total number, ages, gender) and the payments they received can be found in Supplement E.

3.2 Materials and procedure

Exps. 1-3 investigated the projection and at-issueness of the CC of the 20 clause-embedding predicates in (5). The clausal complements of the 20 predicates were realized by 20 clauses (provided in Supplement A), for a total of 400 predicate/clause combinations. These 400 predicate/clause combinations were combined with proper name subjects (a unique name per complement clause) to realize polar questions (in Exps. 1q, 2q, and 3q), negated declaratives (in Exps. 1n, 2n, and 3n), declaratives with the modal adverb *perhaps* (in Exps. 1m, 2m, and 3m), and the antecedents of conditionals (in Exps. 1c, 2c, and 3c). These sentences were presented as utterances by a named speaker. A sample set of target utterances is given in (10): here, the named speaker is *Daniel*, the subject of the clause-embedding predicate is *Cole*, the predicate is *discover*, and the complement clause is *Julian dances salsa*.[5]

(10) a. **Daniel:** "*Did Cole discover that Julian dances salsa?*"
      b. **Daniel:** "*Cole didn't discover that Julian dances salsa.*"
      c. **Daniel:** "*Perhaps Cole discovered that Julian dances salsa.*"
      d. **Daniel:** "*If Cole discovered that Julian dances salsa, Logan will be joyful.*"

The proper names that realized the speakers, the subjects of the clause-embedding predicates, the subjects of the complement clauses, and the subjects of the consequents were all unique.

Projection and at-issueness of the contents of the clausal complements were measured in separate blocks. In the projection blocks across Exps. 1-3, projection was measured with the 'certain that' diagnostic. The target stimuli consisted of the target utterances, as shown in Figure 1.

The at-issueness diagnostics differed between Exps. 1, 2, and 3: at-issueness was measured in Exp. 1q, 2q, and 3q, with variants of the question-based diagnostic of at-issueness, namely the 'asking whether' diagnostic in Exp. 1q, and the 'yes, *p*' diagnostic in Exps. 2q and 3q, as shown in Figure **??**.

, with the 'sure that' diagnostic in Exps. 1n, 1m, and 1c, with the 'yes' diagnostic in Exps. 2q and 3q, with the 'assent with positive continuation' diagnostic in Exps. 2n, 2m, and 2c, and with the 'assent with adversative continuation' diagnostic in Exps. 3n, 3m, and 3c.

To assess whether participants were attending to the task, each experiment also included six control stimuli, which were also utterances made by a named speaker. (The controls are provided in Supplement C.) Each participant saw a random set of 26 stimuli: each set contained one target utterance for each of the 20 clause-embedding predicates (each with a unique complement clause) and the same 6 control stimuli. Each participant saw their set of 26 stimuli twice, once in the projection block and once in the at-issueness block. Block order and within-block trial order was randomized.

In the projection block, target stimuli consisted of a fact and a polar question that was ut- tered by a named speaker, as shown in Figure 1B. The polar questions were formed by real- izing the 20 clauses as the complements of the 20 clause-embedding predicates in Figure 1C. Participants were told to imagine that they are at a party and that, on walking into the kitchen, they overhear somebody ask somebody else a question. Projection was measured using the ?certain that? diagnostic (Djrv & Bacovcin, 2017; Lorson, 2018; Mahler, 2020; Tonhauser et al., 2018): participants were asked to rate whether the speaker was certain of the CC, taking into consideration the fact. They gave their responses on a slider marked ?no? at one end

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[5]The indirect object of *inform* was realized by the proper name *Sam*. The predicates differed in the tense in which they were realized. In polar interrogatives as well as in negated and modalized declaratives, eventive predicates, like *discover* and *hear*, were realized in the past tense and stative predicates, like *know* and *be annoyed*, were realized in the present tense. In the antecedents of conditionals, all predicates were realized in the present tense. For the consequents of the conditional sentences see Supplement B.

(a) Exps. 1q, 2q, and 3q.

(b) Exps. 1n, 2n, and 3n.

(c) Exps. 1m, 2m, and 3m

(d) Exps. 1c, 2c, and 3c

Figure 1: Target trials in projection blocks of Exps. 1, 2, and 3 for the complement *Julian dances salsa*.

(coded as 0) and ?yes? at the other (coded as 1). Greater speaker commitment to the CC should result in higher slider ratings.

Participants were told to imagine that they are at a party and that, on walking into the kitchen, they overhear somebody ask a question. Participants were asked to rate whether the speaker was certain of the CC. They gave their responses on a slider marked 'no' at one end (coded as 0) and 'yes' at the other (coded as 1), as shown in Figure **??**.

After completing the experiment, participants filled out a short, optional survey about their age, their gender, 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 truthful responses, participants were told that they would be paid no matter what answers they gave in the survey.

3.3   Data exclusion

We excluded data from participants who took any experiment more than once and who did not self-declare to be native speakers of American English. We also excluded data from participants based on their ratings on the main clause controls and other criteria given in Supplement E. In each experiment, the data from between 215-281 remaining participants were analyzed. Information on the participants whose data entered into the analysis (total number, ages, gender) can be found in Supplement E.

(a) Exp. 1q.

(b) Exp. 2q.

(c) Exp. 3q

Figure 2: Target trials in at-issueness blocks of Exps. 1q, 2q, and 3q for the complement *Julian dances salsa*.

4 Experiments 1-3: Results

4.1 Comparing at-issueness

4.2 GPP

Further analyses:

- look at how many unique participants

- negative correlation between Q/A and assent might be compound of a) embedding (negation) and b) assent, because we don?t see negative correlation, but no correlation, with other embeddings (modal, conditional)

- compare variance for both projection and at-issueness, under the different embeddings and diagnostics: very little variance for assent diagnostic/negation embedding

- have a look at the predicates that are exceptional to the GPP in Exps1 and 2, how do they behave across the other experiments? Exp3: looks like they are also their own little group

- when we compare negation, modal, conditional with assent diagnostic, we can see what effect embedding has
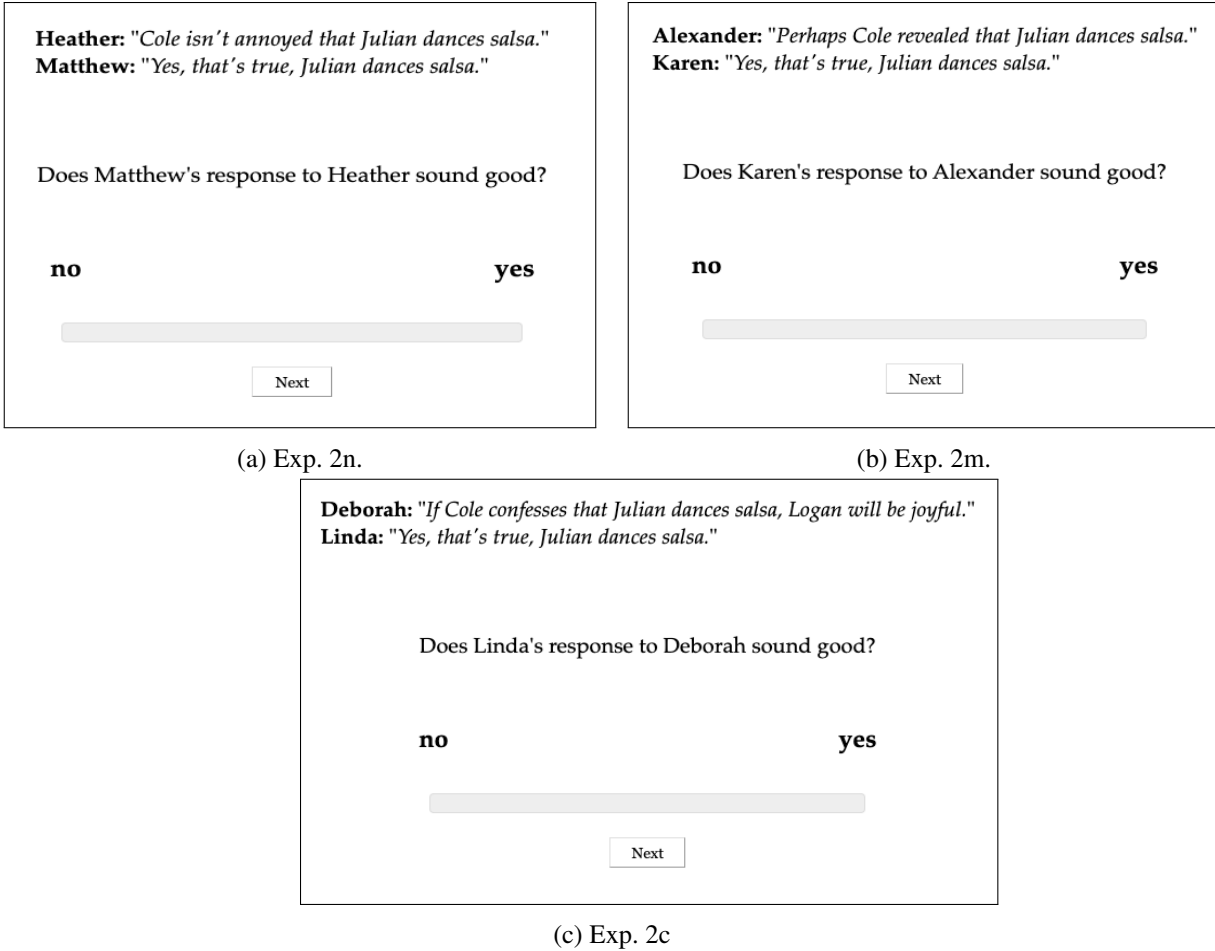
(a) Exp. 2n.

(b) Exp. 2m.

(c) Exp. 2c

Figure 3: Target trials in at-issueness blocks of Exps. 2n, 2m, and 2c for the complement *Julian dances salsa*.

- next experiments: no embedding of the 20 predicates, with assent diagnostic, to compare to prior literature who didn?t use embedding with the assent diagnostic; do assent diagnostic without ?that?s true? anaphor to engage with Snider?s assumption that ?yes? is not really anaphoric in the assent diagnostic and hence also not in the Q/A diagnostic

5 General discussion

6 Conclusions

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(a) Exp. 3n.

(b) Exp. 3m.

(c) Exp. 3c

Figure 4: Target trials in at-issueness blocks of Exps. 3n, 3m, and 3c for the complement *Julian dances salsa*.

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Supplemental materials

A 20 complement clauses

The following clauses realized the complements of the predicates in Exps. 1-3:

1. Mary is pregnant.
2. Josie went on vacation to France.
3. Emma studied on Saturday morning.
4. Olivia sleeps until noon.
5. Sophia got a tattoo.
6. Mia drank 2 cocktails last night.
7. Isabella ate a steak on Sunday.
8. Emily bought a car yesterday.
9. Grace visited her sister.
10. Zoe calculated the tip.
11. Danny ate the last cupcake.
12. Frank got a cat.
13. Jackson ran 10 miles.
14. Jayden rented a car.
15. Tony had a drink last night.
16. Josh learned to ride a bike yesterday.
17. Owen shoveled snow last winter.
18. Julian dances salsa.
19. Jon walks to work.
20. Charley speaks Spanish.

B Consequents for conditional target stimuli in Exps. 1c, 2c, and 3c

The consequents for the conditional target stimuli in Exps. 1c, 2c, and 3c were created with the following considerations in mind. Each complement clause was paired with a unique consequent clause, as shown in the list below for the 20 complement clauses. Each consequent clause consisted of a uniquely named subject and an adjectival predication in the future tense (*will be*); the adjectives all denoted an emotion. We selected the 20 emotion-denoting adjectives based on the valence and arousal values reported in Warriner et al. 2013: 10 of the adjectives had a positive valence, and 10 had a negative valence; all 20 adjective had an arousal value between 4.7 and 6.5.

1. . . . that Mary is pregnant, Esther will be mad.
2. . . . that Josie went on vacation to France, Arnold will be frustrated.
3. . . . that Emma studied on Saturday morning, Liam will be proud.
4. . . . that Olivia sleeps until noon, Elijah will be embarrassed.
5. . . . that Sophia got a tattoo, Ariel will be giddy.
6. . . . that Mia drank 2 cocktails last night, Mariela will be worried.
7. . . . that Isabella ate a steak on Sunday, Liz will be delighted.
8. . . . that Emily bought a car yesterday, Kate will be excited.
9. . . . that Grace visited her sister, Henry will be surprised.
10. . . . that Zoe calculated the tip, Alex will be astonished.
11. . . . that Danny ate the last cupcake, Harper will be disgusted.
12. . . . that Frank got a cat, Lucas will be grouchy.
13. . . . that Jackson ran 10 miles, Kayla will be cheerful.
14. . . . that Jayden rented a car, Brittany will be furious.
15. . . . that Tony had a drink last night, Victoria will be ashamed.
16. . . . that Josh learned to ride a bike yesterday, Mason will be envious.

17. …that Owen shoveled snow last winter, Bianca will be jealous.
18. …that Julian dances salsa, Logan will be joyful.
19. …that Jon walks to work, Caleb will be suspicious.
20. …that Charley speaks Spanish, Jay will be happy.

C   Control stimuli in Exps. 1-3

The control stimuli in Exps. 1-3 were main clauses. For the question embedding (Exps. 1q, 2q and 3q), we used the polar questions in (2). The NRRCs in parentheses are only used in Exps. 2q and 3q to make the use of the assent diagnostics in the at-issueness blocks more natural: like the target stimuli, the control stimuli consist of two clauses, one of which the relevant speaker assents with.

(1)   Sentences for control stimuli in question embedding (Exps. 1q, 2q and 3q)
    a.   Do these muffins (, which are really delicious,) have blueberries in them?
    b.   Does this pizza (, which I just made from scratch,) have mushrooms on it?
    c.   Was Jack (, who is my long-time neighbor,) playing outside with the kids?
    d.   Does Ann (, who is a local performer,) dance ballet?
    e.   Were John's kids (, who are very well-behaved,) in the garage?
    f.   Does Samantha (, who is really into fashion,) have a new hat?

In the negation, modal and conditional embeddings, we used the positive declarative variants of (2), given in (1). Exps. 1n and 1m, we used the sentences in (1) without the NRRCs. We used the sentences in (1) with the NRRCs for Exp. 1c and for Exps. 2 and 3.

(2)   Sentences for control stimuli in negation, modal and conditional embeddings
    a.   These muffins (, which are really delicious,) have blueberries in them.
    b.   This pizza (, which I just made from scratch,) has mushrooms on it.
    c.   Jack (, who is my long-time neighbor,) was playing outside with the kids.
    d.   Ann (, who is a local performer,) dances ballet.
    e.   John's kids (, who are very well-behaved,) were in the garage.
    f.   Samantha (, who is really into fashion,) has a new hat.

Expectations of answers to certainty and at-issueness diagnostics   For the control stimuli in (1) used in Exps. 1q, 2q and 3q, which are polar questions, we expected participants to give low responses in the 'certain that' diagnostic, indicating that the speaker is not certain of the main clause content, i.e., that the content does not project out of the question. For the control stimuli in (2), which are positive declarative sentences, we expected high responses in the 'certain that' diagnostic for the control stimuli, indicating that the speaker is certain of the main clause content. These expectations were borne out, as shown in the third column of Table **??**.

For the at-issueness diagnostics, we expected the main clause content to be at-issue across the diagnostics. We thus expected low responses across all at-issueness diagnostics, given that participants' responses were coded so that the higher a participants' response, the more not-at-issue the content was hypothesized to be (since we investigate whether there is a positive correlation between projection and not-at-issueness). However, as shown in the fourth column of Table A1, the at-issueness ratings are not always low. In particular, xx

Experiment	Control stimuli	Certainty Mean rating	At-issueness Mean rating	Measure
1q	(1)	.14	.05	asking whether c
2q	(1) with NRRC	.18	.07	*yes*, c
3q	(1) with NRRC	.17	.28	*yes*, but $\neg c'$
1n	(2)	.95	.04	sure that c
1m	(2)	.96	.03	sure that c
1c	(2) with NRRC	.94	.08	sure that c
2n	(2) with NRRC	.96	.22	*yes, that's true*, c
2m	(2) with NRRC	.96	.25	*yes, that's true*, c
2c	(2) with NRRC	.96	.22	*yes, that's true*, c
3n	(2) with NRRC	.94	.44	*yes, that's true*, but $\neg c'$
3m	(2) with NRRC	.93	.50	*yes, that's true*, but $\neg c'$
3c	(2) with NRRC	.93	.53	*yes, that's true*, but $\neg c'$

Table A1: Mean certainty and at-issueness ratings for control stimuli, for self-declared American English participants

     Exp. 3q
A: Do these muffins, which are really delicious, have blueberries in them?
B: Yes, but they aren't really delicious.
     Exp. 2n, 2m, 2c
A: These muffins, which are really delicious, have blueberries in them.
B: Yes, that's true, they have blueberries in them.
     Exp. 3n, 3m, 3c
A: These muffins, which are really delicious, have blueberries in them.
B: Yes, that's true, but they aren't really delicious.

D   Data exclusion

This supplement provides information on the recruited participants, the criteria by which participants' data were excluded, the remaining participants (that is, the participants whose data entered into the analysis), and the payment for each of Exps. 1-3. Table A3 provides information on the recruited and remaining participants, including the total number, the range of the participants' ages, the mean ages of the participants, and their self-reported gender ('f' = female, 'm' = male, 'o' = other, 'u' = undeclared). No gender data was collected in Exp. 1q. Participants' data were excluded based on the following criteria:

- 'multiple': Due to an experimental glitch, some participants participated more than once. Since no information was available on which one was their first take, those participants' data was removed (which means that for each participant who took the experiment twice, at least two data sets were removed).

- 'language': Participants' data were excluded if they did not self-identify as native speakers of American English.

- 'controls': Participants' data were excluded if their mean rating on the 6 main clause control items in the projection block was more than 2 sd above the group mean (in Exps. 1q, 2q, and 3q) or more than 2 sd below the group mean (in the remaining experiments). Participants' data were also excluded

if their mean rating on the 6 main clause control items in the at-issueness block was more than 2 sd above the group mean (across Exps. 1-3).

- 'variance': Participants' data were excluded if they always selected roughly the same point on the response scale for the target stimuli. We identified such participants by identifying participants whose mean variance on the target stimuli was more than 2sd below the group mean variance on the target stimuli, and manually inspecting their response patterns.

Participants took around 9-11 minutes to complete the various experiments. Participants were paid more in Exps. 1c, 2c, and 3c than the remaining experiments because the target stimuli in those experiments were longer (as they consisted of conditionals). More women than men were recruited in many of the experiments because they were run at a time when Prolific apparently went viral on TikTok, resulting in a large number of young women registering for the service (around July 24, 2021; see `https://blog.prolific.co/we-recently-went-viral-on-tiktok-heres-what-we-learned/`, last accessed February 4, 2022).

E   Comparing projection with different entailment-canceling environments

	Recruited participants			Exclusion criteria				Remaining participants			payment
Exp.	total	ages (mean)	f/m/o/u	multiple	language	controls	variance	total	ages (mean)	f/m/o/u	
1q	300	19-74 (38.2)	–	5	7	35	0	242	21-74 (39.2)	–	$1.70
1n	300	18-74 (33.2)	150/145/5/0	0	8	17	1	274	18-74 (33.3)	141/128/5/0	$1.70
1m	300	18-74 (32.7)	150/141/7/2	0	0	19	0	281	18-74 (32.7)	144/129/7/1	$1.70
1c	300	18-58 (25.9)	249/45/6/0	0	6	26	2	266	18-58 (24.8)	235/25/6/0	$2.15
2q	250	18-58 (25.5)	201/43/6/0	0	4	24	1	220	18-58 (24.8)	187/28/5/0	$1.70
2n	250	18-69 (33.2)	127/114/6/1	1	4	29	0	215	18-69 (33.1)	113/95/6/1	$1.70
2m	251	18-74 (31.7)	132/113/6/0	0	4	27	0	220	18-70 (31.9)	116/98/6/0	$1.70
2c	250	18-56 (24.5)	212/30/8/0	0	0	26	0	224	18-56 (24.4)	195/24/5/0	$2.15
3q	250	18-66 (32.4)	140/102/7/1	0	4	20	0	225	18-66 (32.6)	125/93/7/0	$1.70
3n	250	18-70 (24.6)	114/31/5/0	0	5	13	4	228	18-70 (24.3)	198/25/5/0	$1.70
3m	250	18-63 (25.5)	205/40/5/0	0	3	14	0	233	18-63 (24.8)	197/31/5/0	$1.70
3c	250	18-59 (27.5)	182/64/4/0	0	3	17	0	230	18-59 (26.7)	177/49/4/0	$2.15

Table A2: Recruited participants, excluded data, and remaining participants in Exps. 1, 2 and 3