

Projection inferences: On the role of not-at-issueness

Judith Tonhauser

University of Stuttgart

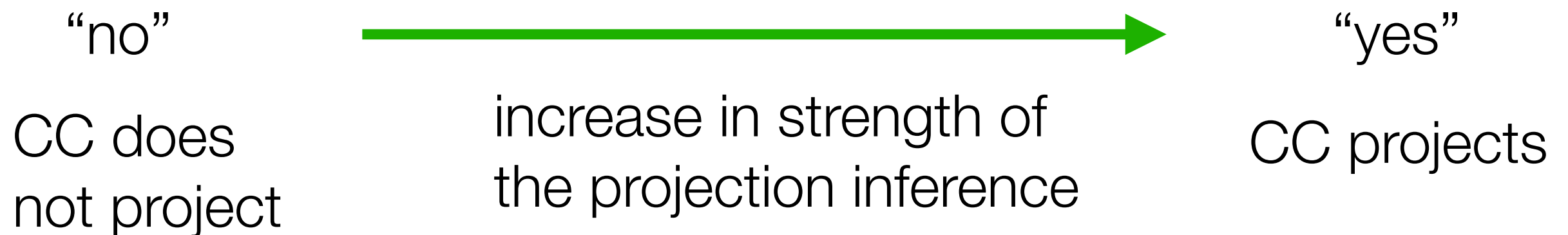


University of Tübingen, 17.6.2021

Projection inferences

Alex: “*Did Kim discover that Sandy’s work is plagiarized?*”

Do you, the listener, infer that Alex is committed to the truth of the content of the complement, that Sandy’s work is plagiarized?



Central questions

In drawing projection inferences, which information sources do listeners attend to, and how are they integrated?

- Lexical meaning
 - Common ground
 - Information structure
 - At-issueness
 - Information about the speaker
 - Prior beliefs (a.k.a. “world knowledge”)
-
- part 1
- part 2
- INTEGRATION

(e.g., Stalnaker 1972; Karttunen 1974; Gazdar 1979; Heim 1982; Beaver 1995, 2010; Simons 2001; Simons et al 2010, 2017; Schlenker 2010; Beaver et al 2017; Djärv & Bacovcin 2017; Schlenker 2010; Abrusán 2011, 2013, 2016; Tonhauser, Beaver, & Degen 2018; Mahler 2020)

Projection Principle

Simons, Tonhauser, Beaver & Roberts 2010 (*SALT*); Beaver, Roberts, Simons & Tonhauser 2017 (*Annual Review of Linguistics*)

Content *c* projects if and only if it is not-at-issue.

1. Martha, a mathematician, solved the problem.
at-issue: Martha solved the problem
not-at-issue: Martha is a mathematician
2. Did Martha, a mathematician, solve the problem?
doesn't project: Martha solved the problem
projects: Martha is a mathematician

Projection Principle

Simons, Tonhauser, Beaver & Roberts 2010 (*SALT*); Beaver, Roberts, Simons & Tonhauser 2017 (*Annual Review of Linguistics*)

Content *c* projects if and only if it is not-at-issue.

1. Context: Henry and Harriet are an academic couple that lives on the West Coast.
A: Why is Henry in such a bad mood?
B: Did he discover that Harriet was at Princeton for a job interview?
2. Context: Henry is a nosy colleague of Harriet and well-informed about her whereabouts.
A: Where was Harriet yesterday?
B: Did Henry discover that she was at Princeton for a job interview?

Projection variability

Karttunen 1971:63

- (1) a. Did you regret that you had not told the truth?
b. Did you discover that you had not told the truth?

“[(1a)] commits the speaker to the view that the addressee has not told the truth.” In [(1b)] “the speaker is not sure about the truth of the complement.”

Projective content “differs from each other...in that some appear more robust than others” (Kadmon 2001: ch.11).

See also, e.g.: Simons 2001; Chemla 2009; Smith & Hall 2011, Xue & Onea 2011; Abrusán 2011, 2016; Tonhauser, Beaver, Roberts & Simons 2013; Romoli 2015.

Gradient Projection Principle

Tonhauser, Beaver & Degen 2018 (*Journal of Semantics*)

Content *c* projects to the extent that it is not at-issue.

Research questions:

1. How projective is projective content?
2. Are not-at-issueness and projection correlated, as predicted by the Gradient Projection Principle?

Exp 1a and 2a:

- Exp 1a: ratings of projection and not-at-issueness (“asking whether” diagnostic) in a within-participant design
- Exp 2a: ratings of not-at-issueness (“are you sure?” diagnostic)

Materials (Exp 1a / 2a)

9 projective contents associated with English expressions

1. Conventional implicatures (2): non-restrictive relative clauses and nominal appositives:

Is Sam, who homeschools his daughter, joining us?

Is Sam, a teacher, joining us?

2. Presuppositions (7)

A. Content of the complement of *discover*, *be annoyed* and *know*

B. Possessive noun phrases (*Sam's daughter...?*)

C. Prejacent of *only*, *stupid* (*Did only Kim sleep?*)

D. Pre-state content of *stop* (*Did Kim stop sleeping?*)

Developing diagnostics for projection and not-at-issueness

Exp 1a

Tonhauser, Beaver & Degen 2018 (*Journal of Semantics*)

Footnote 8

- The projection diagnostic needs to apply to content embedded under an entailment-canceling operator.

Alex: “*Did Kim discover that Sandy’s work is plagiarized?*”

Is Alex certain that Sandy’s work is plagiarized?

- We wanted to measure the not-at-issueness of the same content in the same utterance.

Is Alex asking whether Sandy’s work is plagiarized?

This diagnostic operationalizes the assumption that a polar question partitions the context set by its at-issue content, not by its not-at-issue content (e.g., Amaral et al 2007, Tonhauser 2012).

Developing diagnostics for projection and not-at-issueness

Exp 2a

Tonhauser, Beaver & Degen 2018 (*Journal of Semantics*)

Footnote 8

- The projection diagnostic needs to apply to content embedded under an entailment-canceling operator.

Alex: “*Did Kim discover that Sandy’s work is plagiarized?*”

- Exp 2 measured not-at-issueness with a different diagnostic.

Alex: “*Kim discovered that Sandy’s work is plagiarized.*”

Kate: “*Are you sure?*”

Alex: “*Yes, I am sure that Sandy’s work is plagiarized.*”

Did Alex answer Kate’s question?

This diagnostic operationalizes the assumption that at-issue content is up for debate, but not-at-issue content is not (e.g.,

Amaral et al 2007, Tonhauser 2012, Murray 2014, Syrett & Koev 2017).

Diagnosing projection (Exp 1a): “certain that” diagnostic

(e.g., Tonhauser 2016, Djärv & Bacovcin 2017, Tonhauser et al 2019, de Marneffe et al 2019, Mahler et al 2019, Mayler 2020, Degen & Tonhauser to appear)

Nicholas asks: "*Was Martha's new BMW expensive?*"

Is Nicholas certain that Martha has a new BMW?

no yes

Next

Diagnosing not-at-issueness: “asking whether” (Exp 1a)

Nicholas asks: "*Was Martha's new BMW expensive?*"

Is Nicholas asking whether Martha has a new BMW?

no yes

Next

Exp 1a: Every participant rated the projection and not-at-issueness of 9 target contents, as well as of 6 main clause contents.

Diagnosing not-at-issueness: “sure that” (Exp 2a)

Ashley: *"Martha's new BMW was expensive."*

Edward: *"Are you sure?"*

Ashley: *"Yes, I'm sure that Martha has a new BMW."*

Did Ashley answer Edward's question?

no **yes**

☐

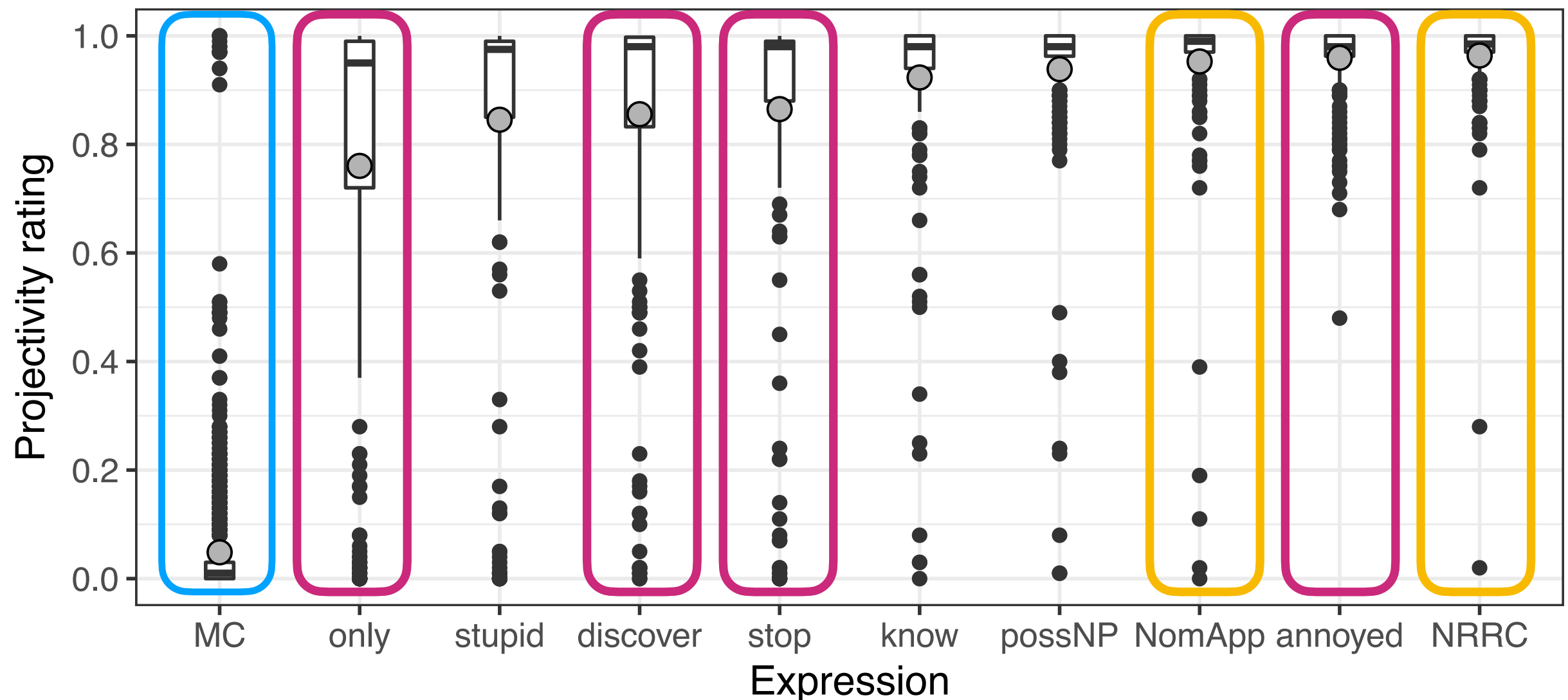
Next

Exp 2a: Every participant rated the not-at-issueness of 9 target contents, as well as of 6 main clause contents.

Results (Exp 1a): Projection variability

Tonhauser, Beaver & Degen 2018 (*Journal of Semantics*)

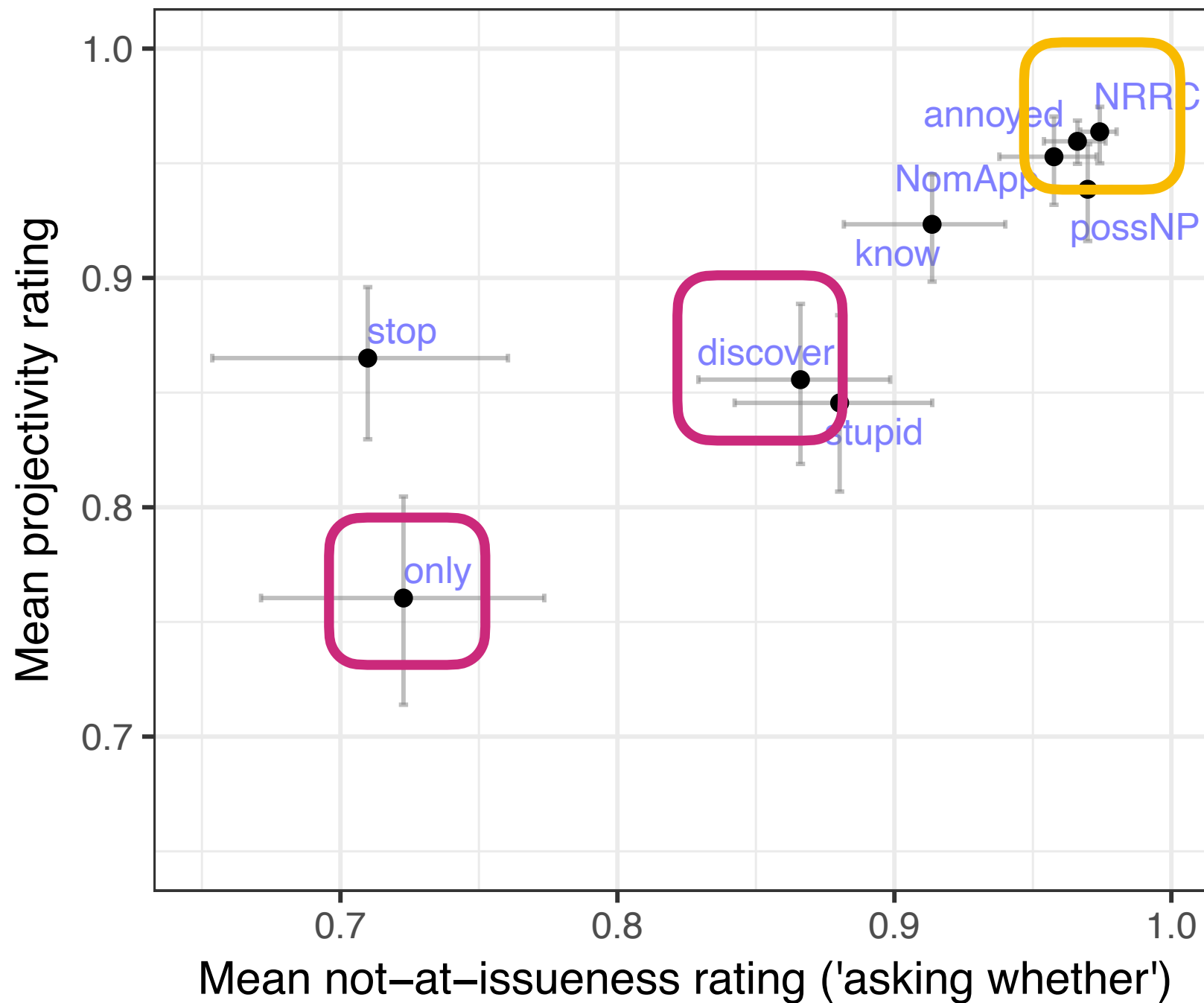
210 self-declared speakers of American English



Research question 1: Projective content varies in how projective it is (in ways not predicted by contemporary theories).

Results (Exp 1a): Projection correlates with not-at-issueness

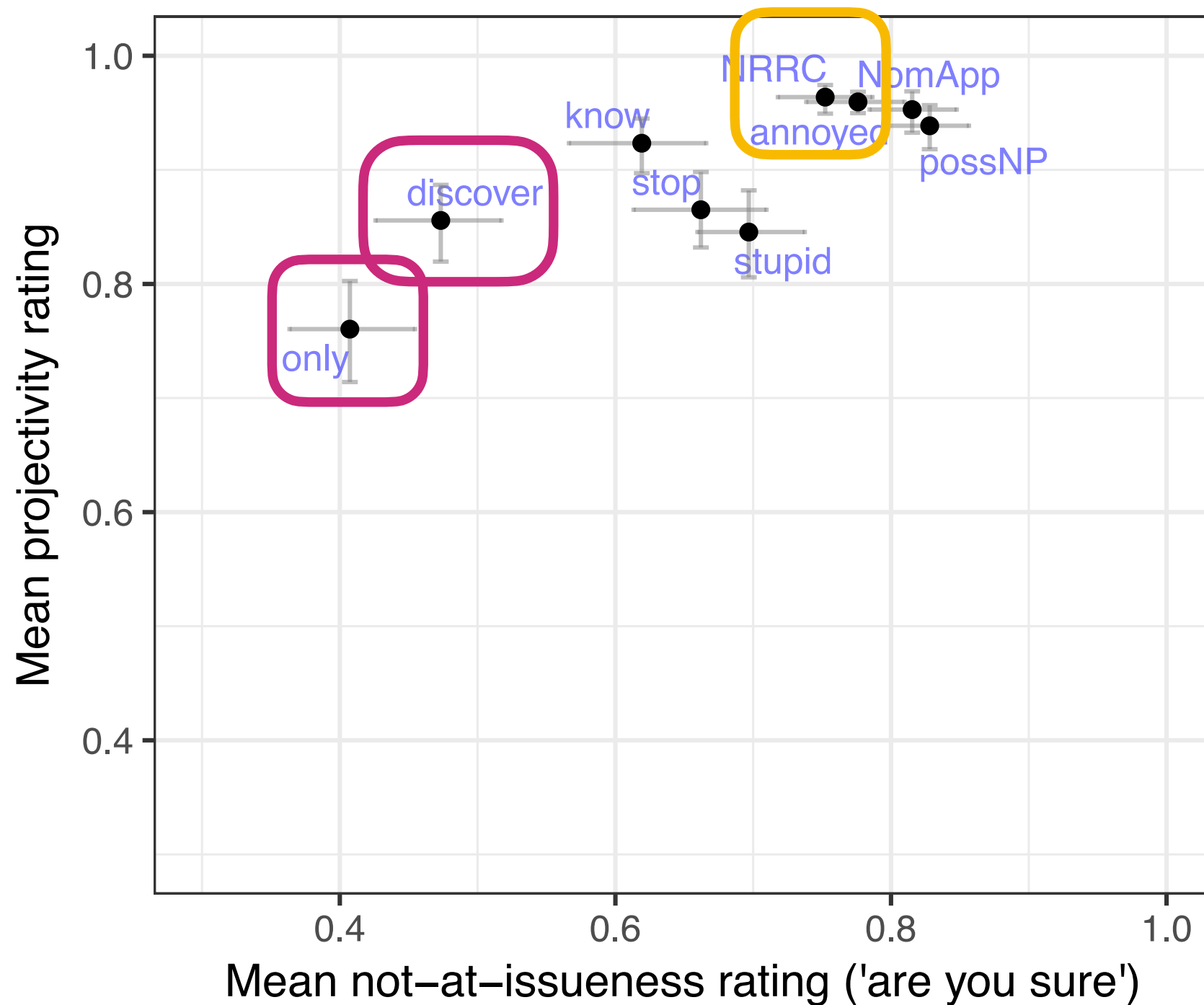
Tonhauser, Beaver & Degen 2018 (*Journal of Semantics*)



Linear ME model predicting projection from not-at-issueness (and the appropriate RE structure): $\beta = 0.37$, $SE = 0.10$, $t = 3.70$, $\chi^2(1) = 9.20$, $p < .003$

Results (Exp 2a): Projection correlates with not-at-issueness

Tonhauser, Beaver & Degen 2018 (*Journal of Semantics*)



Linear ME model predicting projection from not-at-issueness (and the appropriate RE structure): $\beta = 0.29$, $SE = 0.06$, $t = 5.21$, $\chi^2(1) = 20.94$, $p < .0001$

Gradient Projection Principle

Tonhauser, Beaver & Degen 2018 (*Journal of Semantics*)

Content c projects to the extent that it is not at-issue.

Research questions:

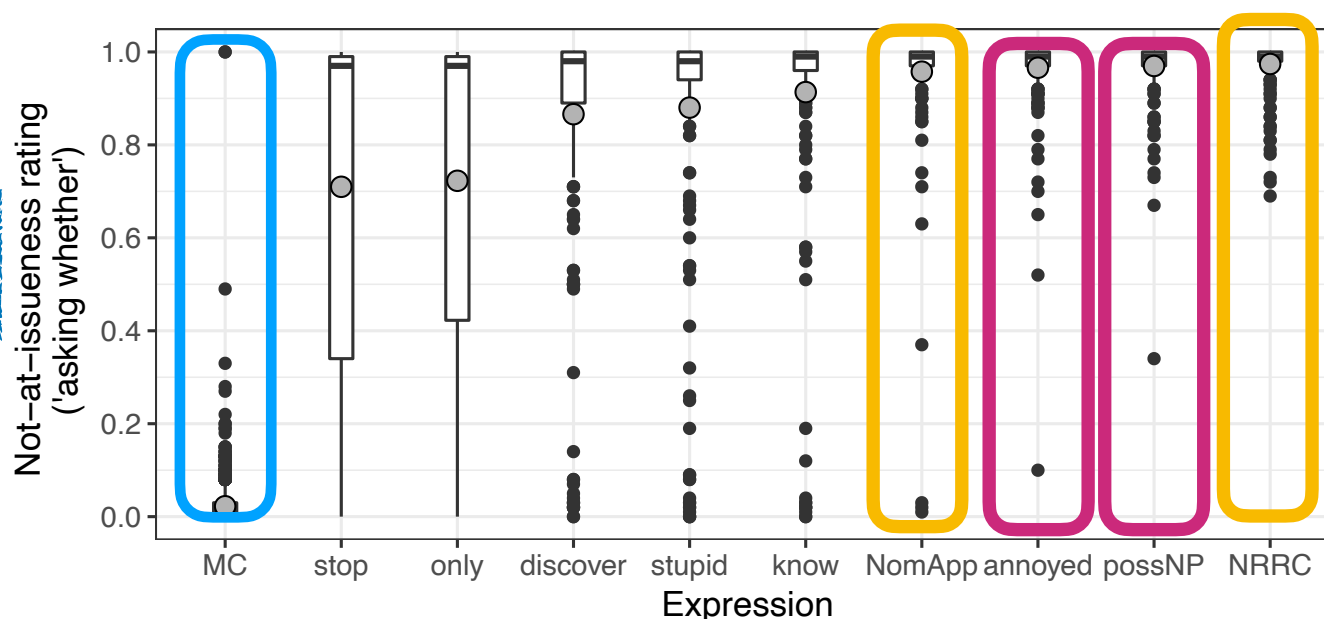
1. How projective is projective content?
 - Conventional implicatures are highly projective.
 - Presuppositions vary in projection, in ways not yet captured by theoretical accounts.
2. Are not-at-issueness and projection correlated, as predicted by the Gradient Projection Principle?



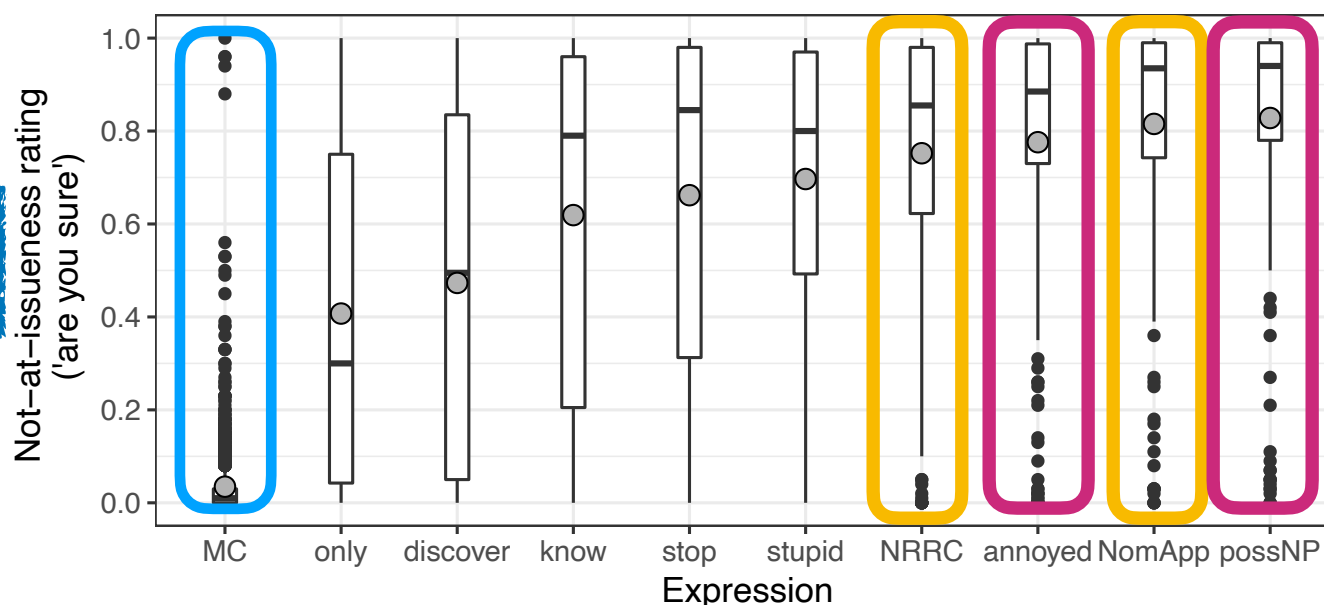
Comparing the two not-at-issueness diagnostics

- The “asking whether” and “are you sure?” diagnostics operationalize different assumptions about (not-)at-issue content. Both provide evidence for the Gradient Projection Principle.
- But there are also differences between the two diagnostics.

Exp 1a:



Exp 2a:



- Numerically higher ratings in Exp 1a than Exp 2a
- Greater spread in Exp 2a than in Exp 1a

Ongoing work:
What are these differences due to?

Central questions

In drawing projection inferences, which information sources do listeners attend to, and how are they integrated?

- Lexical meaning
 - Common ground
 - Information structure
 - At-issueness/QUD
 - Information about the speaker
 - Prior beliefs (a.k.a. “world knowledge”)
-
- part 1 part 2
- INTEGRATION

(e.g., Stalnaker 1972; Karttunen 1974; Gazdar 1979; Heim 1982; Beaver 1995, 2010; Simons 2001; Simons et al 2010, 2017; Schlenker 2010; Beaver et al 2017; Djärv & Bacovcin 2017; Schlenker 2010; Abrusán 2011, 2013, 2016; Tonhauser, Beaver, & Degen 2018; Mahler 2020)

Roadmap for part 2

In drawing inferences about the projection of the content of the complement of clause-embedding predicates, how are predicate meaning, at-issueness, and prior beliefs integrated?

1. Hypotheses about the influence of predicate meaning, at-issueness, and prior beliefs on projection
2. Comprehension experiment
3. Information sources and their interactions
 - A. Predicate meaning
 - B. Predicate meaning and at-issueness
 - C. Predicate meaning and prior beliefs
 - D. Predicate meaning, at-issueness, and prior beliefs

Predicate meaning

Alex: “*Did Kim discover that Sandy’s work is plagiarized?*”

- English has thousands of clause-embedding predicates:
be annoyed, be right, know, announce, confirm, realize, acknowledge, pretend, confirm, think, consider,...
(see White & Rawlins 2018, Ross & Pavlick 2019)
- Mostly factive predicates have been investigated.
Tonhauser, Beaver, and Degen 2018 (*Journal of Semantics*)
know, notice > discover > reveal
- Empirical evidence that the content of the complement of some non-factive predicates may also project. (e.g., Simons et al 2017, de Marneffe et al 2019, Tonhauser & Degen under re-review)

20 clause-embedding predicates

(Tonhauser & Degen under re-review; Degen & Tonhauser accepted *Open Mind*)

Factive

be annoyed

know

discover

reveal

see

Non-factive

prove

confirm

establish

announce

confess

admit

acknowledge

hear

inform

pretend

think

say

suggest

be right

demonstrate

At-issueness/QUD

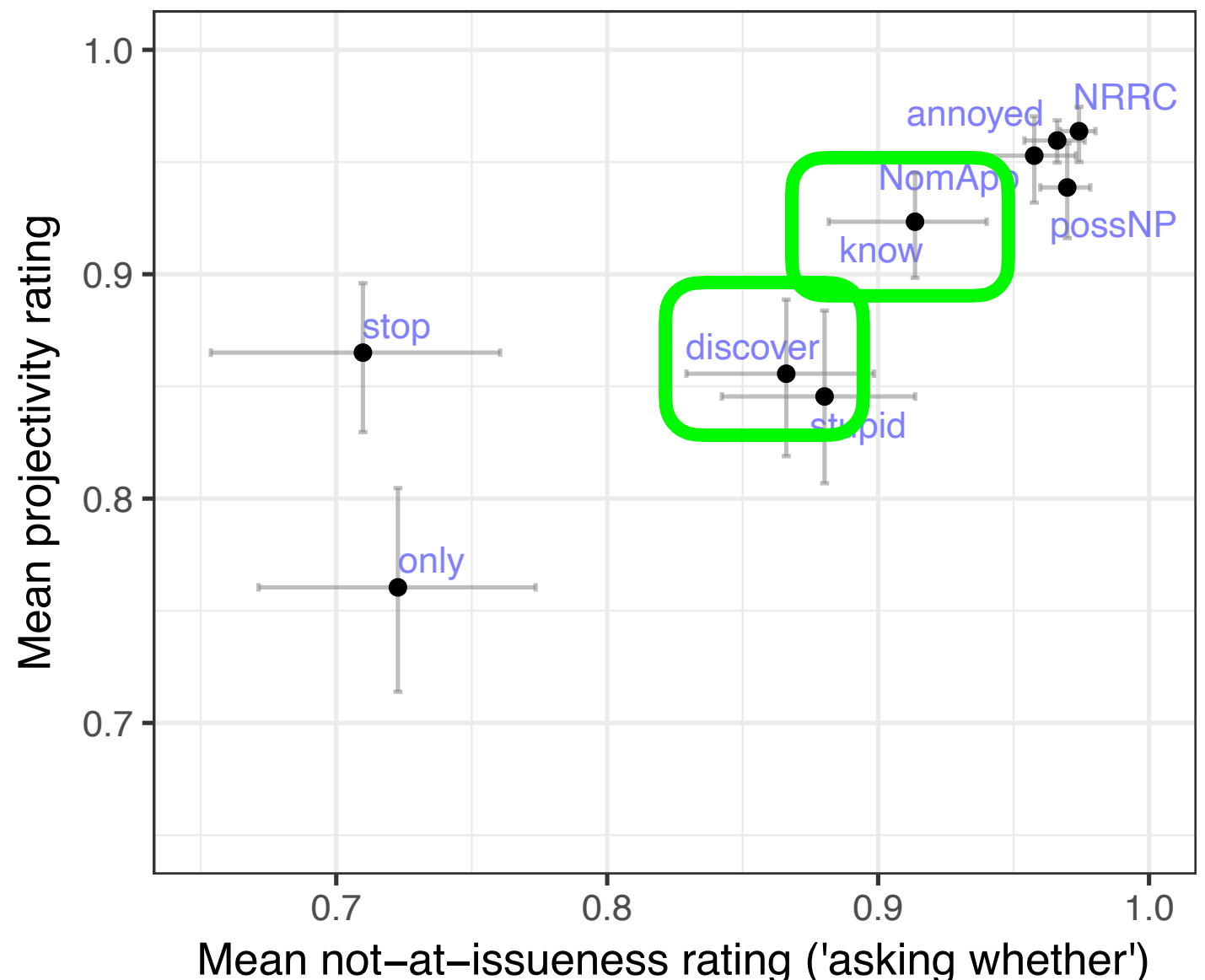
Tonhauser, Beaver, and Degen 2018 (Journal of Semantics)

Gradient Projection Principle:
Content projects to the extent that it is not at-issue.

(building on Simons et al 2010, 2017; Xue & Onea 2011; Cummins & Rohde 2015)

Alex:

*“Did Kim discover /
Does Kim know
that Sandy’s work is
plagiarized?”*



Prior beliefs

Listeners bring their beliefs about the world (\approx world knowledge) to bear on utterance interpretation, e.g., in ambiguity resolution or scalar implicatures, and also projection.

e.g., Winograd 1972; Altmann & Kamide 1999; Chambers et al 2002, 2004; Hagoort et al 2004; Bicknell & Rohde 2009; Degen et al 2015; Kravtchenko & Demberg 2015; Tessler & Goodman 2019; Mahler 2020

Tonhauser, Beaver, & Degen 2018: Some content is more projective than other content.

Alex: *“Does Kim know that ...Jane has a sick aunt?
...Jack is playing outside with the kids?”*

Hypothesis: Content is more projective the higher its prior probability, i.e., the stronger listeners' prior belief in the content.

Roadmap

In drawing inferences about the projection of the content of the complement of clause-embedding predicates, how are predicate meaning, at-issueness, and prior beliefs integrated?

1. Hypotheses about the influence of predicate meaning, at-issueness, and prior beliefs on projection
2. Comprehension experiment
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Materials

800 combinations of a polar question and a fact



Fact: Julian is German.

Sally: “*Did Cole demonstrate that Julian dances salsa?*”

400 polar questions:

- 20 clause-embedding predicates (e.g., *discover*, *confirm*)
- 20 complements (e.g., *Julian dances salsa*)

2 facts per complement to manipulate the prior:

High probability fact: Julian is Cuban.

Low probability fact: Julian is German.

Materials and blocks

505 self-declared native speakers of American English

Each participant: 20 randomly created combinations of a polar question (20 unique predicates and complements) and a fact (10 higher probability, 10 lower probability).

Fact: Julian is German.

Sally: *“Did Cole demonstrate that Julian dances salsa?”*

Three blocks (order of 2./3. random)

1. Prior belief (of the CC, given the fact)
2. Projection (of the CC, given the fact and the predicate)
3. At-issueness (of the CC, given the fact and the predicate)

Block 1: Prior probability of the CC, given the fact

lower
probability
fact

Fact: Julian is German.

How likely is it that Julian dances salsa?

complement

impossible

definitely

Next

response

Each participant rated the prior probability of their 20 CC/fact combinations (10 with higher and 10 with lower probability facts).

Block 2: Projection of the CC, given fact and predicate

fact + utterance

Fact (which Brian knows): Julian is German.

Brian asks: *"Did Cole demonstrate that Julian dances salsa?"*

projection question

Is Brian certain that Julian dances salsa?

response

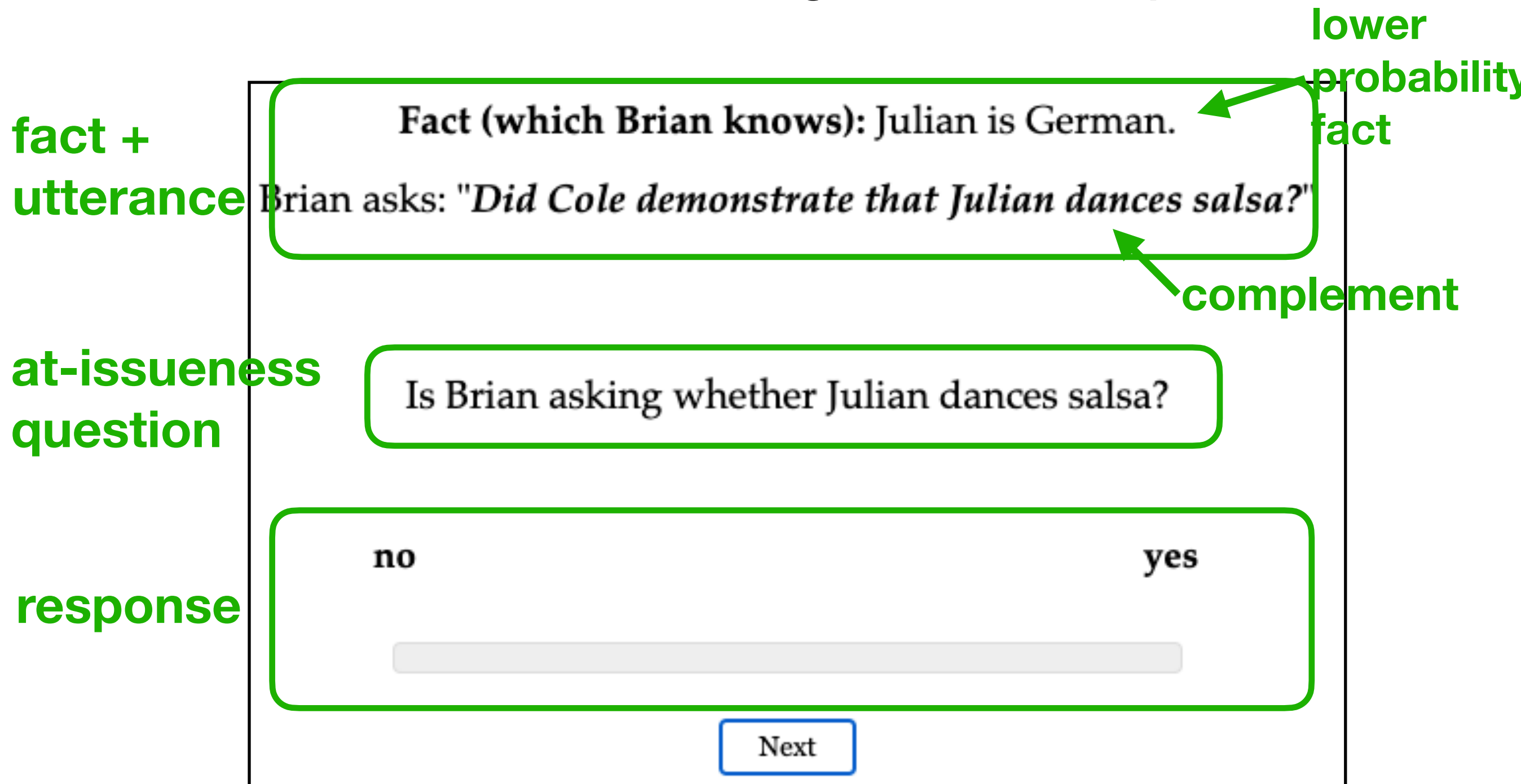
no yes

Next

lower probability fact complement

Each participant rated the projection of their 20 CCs, given a fact and a predicate (and 6 main clause controls).

Block 3: At-issueness of the CC, given fact and predicate



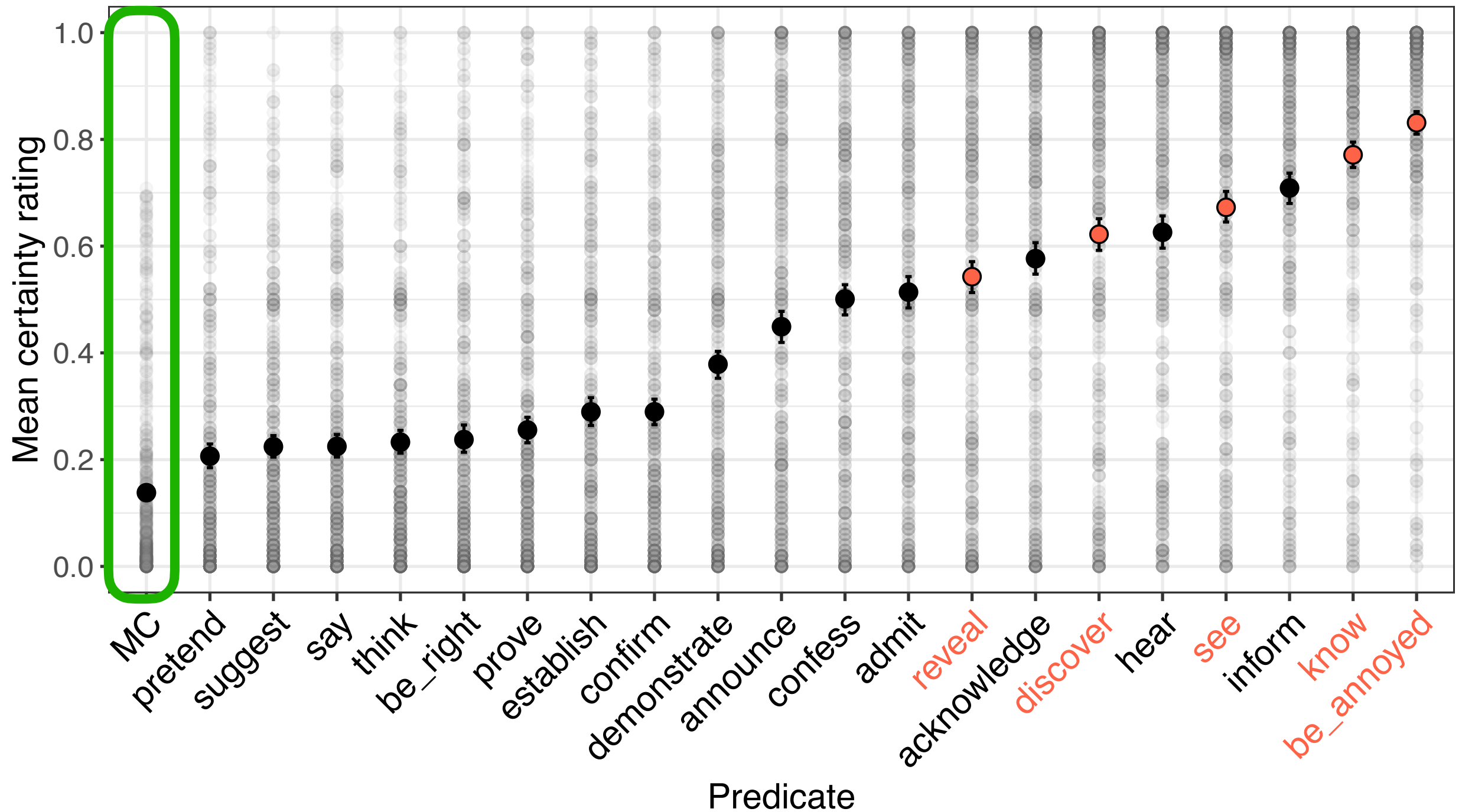
Each participant rated the projection of their 20 CCs, given a fact and a predicate (and 6 main clause controls).

Roadmap

In drawing inferences about the projection of the content of the complement of clause-embedding predicates, how are predicate meaning, at-issueness, and prior beliefs integrated?

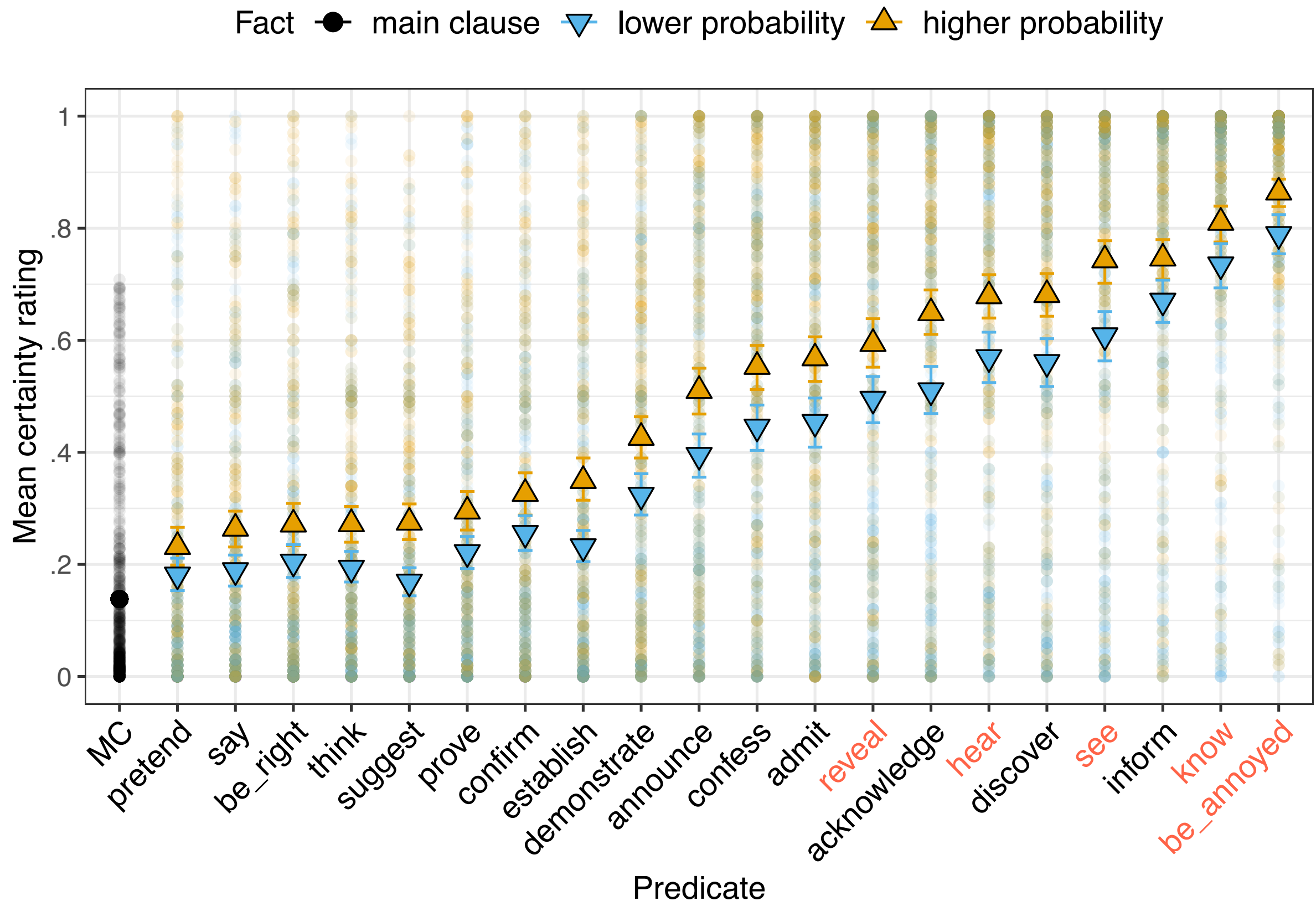
1. Hypotheses about the influence of predicate meaning, at-issueness, and prior beliefs on projection
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Predicate meaning modulates projection



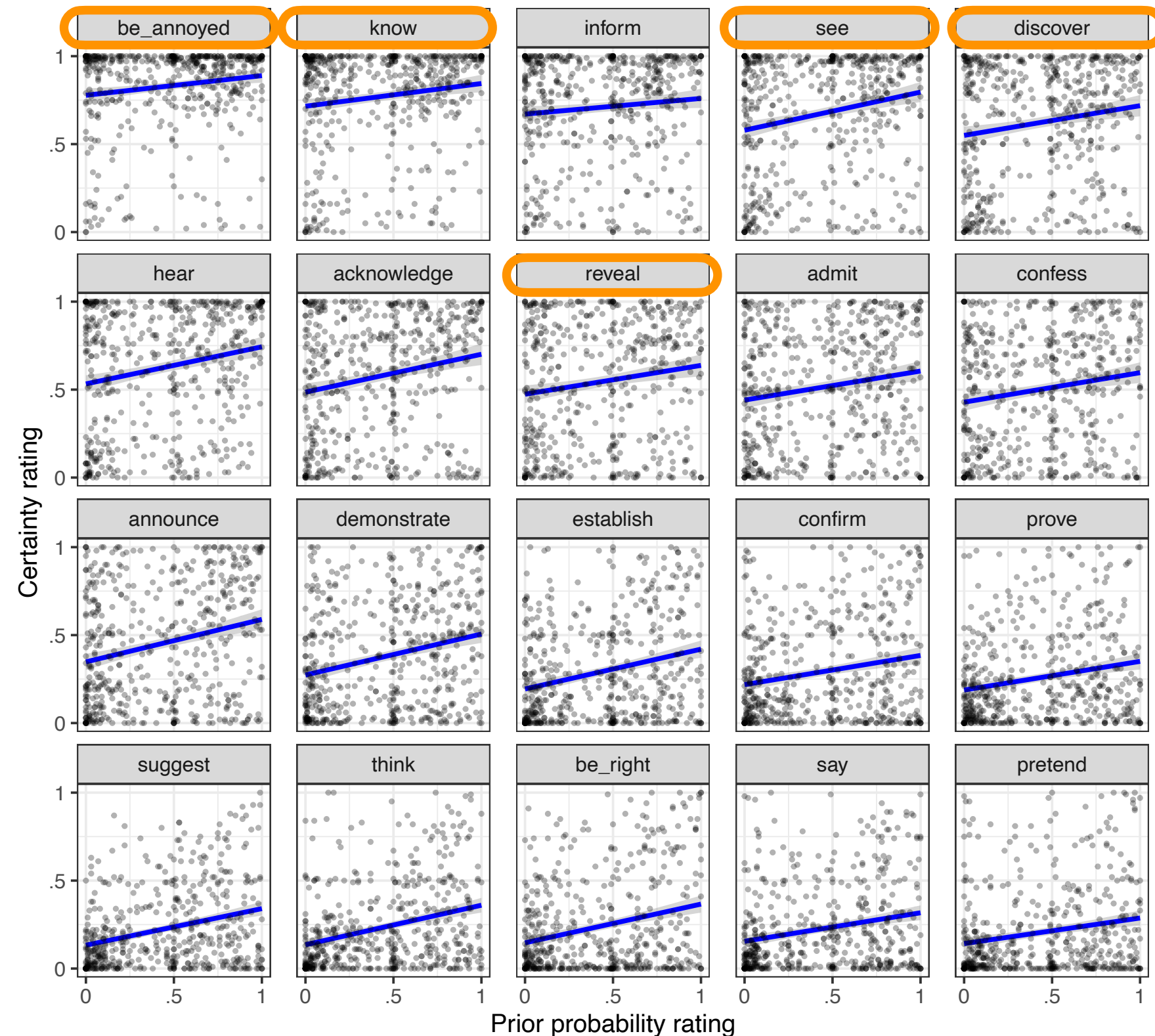
Tonhauser & Degen under re-review: the CC of all 20 predicates is projective compared to (non-projective) main clause content, albeit to different degrees.

Prior probability: Higher probability content is more projective



ME linear regression predicting certainty ratings from fact type, random by-item and by-participant intercepts and slopes for fact type ($\beta = 0.094$, S E = 0.007, $t = 12.94$, $p < .0001$).

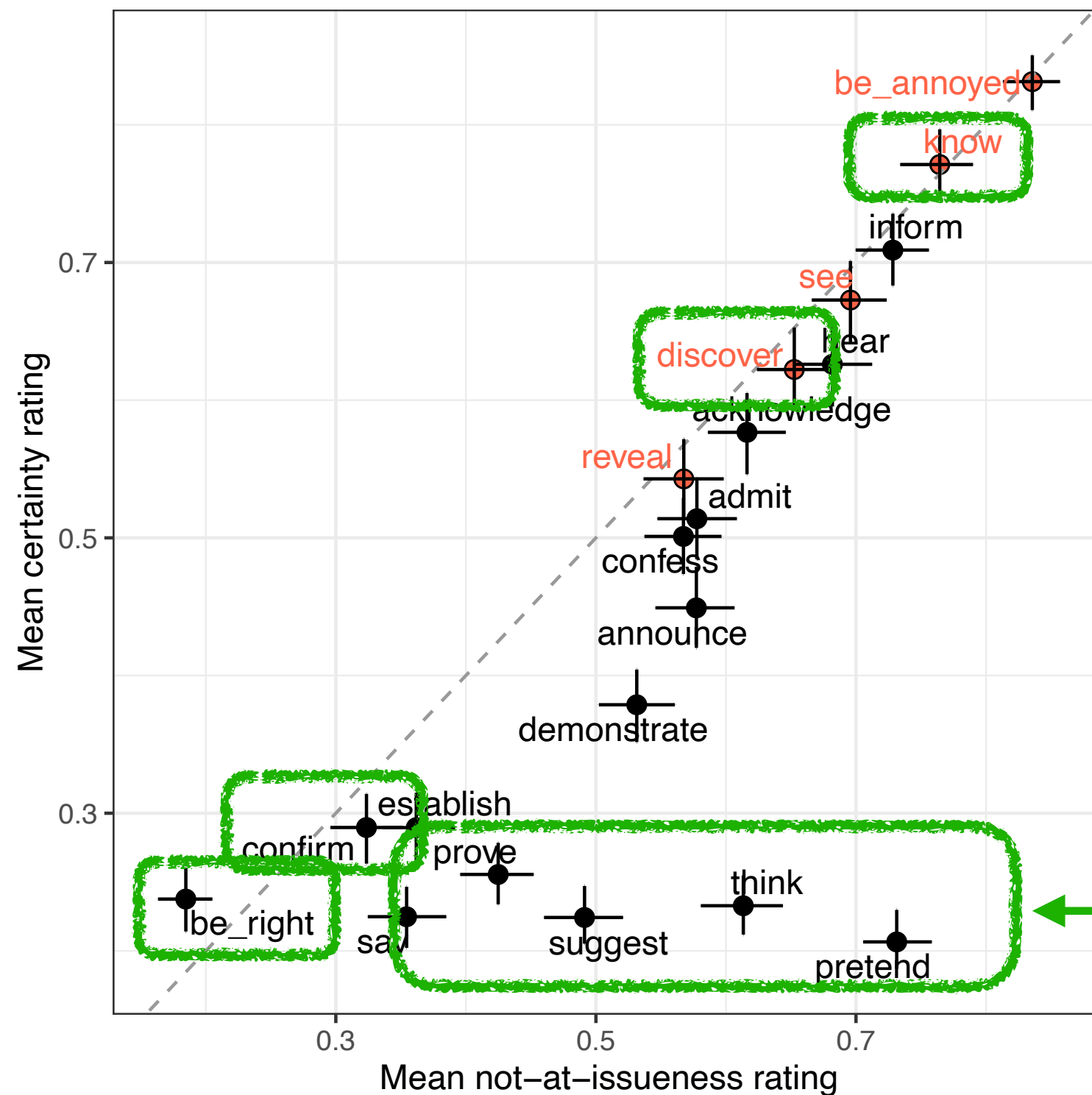
Prior probability: Higher probability content is more projective



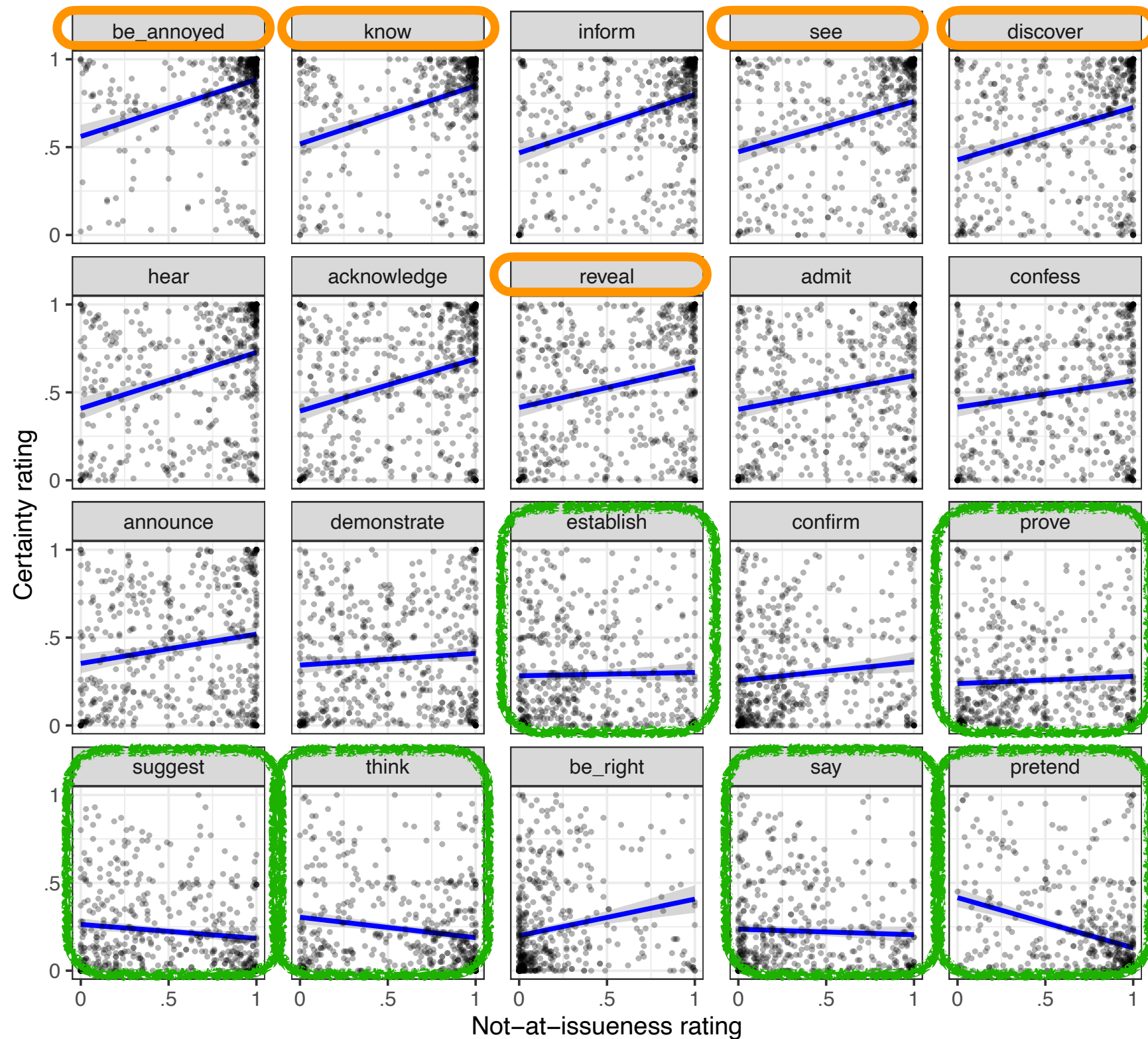
...by-group- and
by-participant

ME linear regression predicting certainty ratings from prior ratings, random by-item and by-participant intercepts and slopes for prior ($\beta = 0.17$, $SE = 0.01$, $t = 14.1$, $p < .0001$).

At-issueness: The more not-at-issue, the more projective



At-issueness: The more not-at-issue, the more projective



...by-group- and
by-participant

← exceptions!

Projection of the CC of clause-embedding predicates...

...is modulated by:

INTEGRATION

- predicate meaning (and the CC of so-called non-factive predicates is projective, too!)
- prior beliefs: independent effect seen for all predicates, in support of Tonhauser, Beaver, and Degen 2018
- at-issueness: effect seen for broader set of predicates (in support of Tonhauser, Beaver, and Degen 2018), but not for all predicates (*establish, say, prove, suggest, think, pretend*).

Question for future research: How does predicate meaning interact with at-issueness, to predict projection?

At-issueness and prior beliefs are not independent

Non-redundancy principle (Tonhauser, de Marneffe, and Degen 2020)

The more the interpreter takes content to be a priori true, the less likely the content is to be at-issue in an utterance.

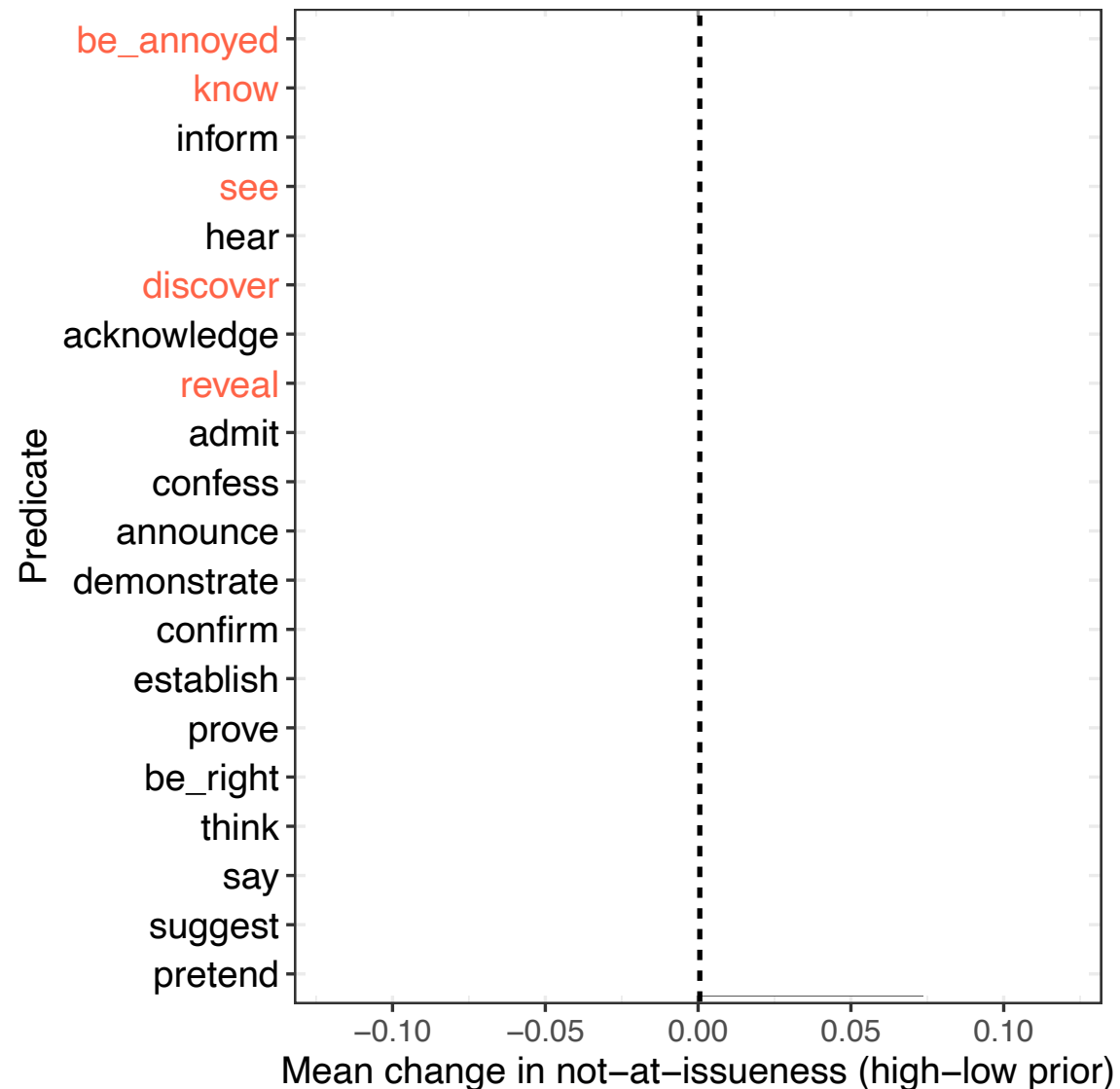
Sandy: *“Did Paul discover that Julian dances salsa?”*

Prediction: The higher the content prior, the more not-at-issue the content.

Expectation: The higher the content prior, the more not-at-issue the content.



predicted:



data:



exceptions

Question for future research: How do prior probability and at-issueness interact with predicate meaning?

In drawing projection inferences, which information sources do listeners attend to, and how are they integrated?

- The CCs of clause-embedding predicates is projective, albeit to varying degrees (not just factive predicates).

(de Marneffe, Simons, & Tonhauser 2019; Tonhauser and Degen under-rereview)

- Prior content probabilities modulate projection, across all 20 predicates (including so-called factive and non-factive ones).

(Degen & Tonhauser accepted; as predicted in Tonhauser et al 2018)

- At-issueness modulates projection, but interacts with predicate meaning in ways not yet predicted.

(only partially confirms Tonhauser, Beaver, & Degen 2018)

- Prior probability and at-issueness interact with predicate meaning in predicting projection.

(contra Tonhauser, de Marneffe, & Degen 2020)

HOW?

Supplementary slides

Prior probability of the 20 CCs is influenced by their facts

