

The Gradient Projection Principle: Further evidence and challenges

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Based on joint work with **Judith Degen** (Stanford U), **Marie-Catherine de Marneffe** (Ohio State U) and **Taylor Mahler** (Ohio State U)

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Gradient Projection Principle (GPP)

Tonhauser, Beaver & Degen 2018:400 (*Journal of Semantics*)

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

The goal of this talk is to provide further empirical support for the Gradient Projection Principle.

Roadmap:

1. Projective content and not-at-issueness
2. Diagnostics for at-issueness
3. Tonhauser et al 2018: Evidence for the GPP
4. Further investigations of the GPP
5. Concluding remarks

Projective content

Family of Sentences variants

- (1) a. *“Does Cole know that Julian dances salsa?”*
b. *“Cole doesn’t know that Julian dances salsa.”*

↪ Julian dances salsa

**The content of the
complement is
projective content**

Information sources modulating projection inferences

In drawing projection inferences, interpreters attend to a number of information sources:

- Lexical meaning *“Does Cole know that Julian dances salsa?”*
- At-issueness *“Did Cole discover...?”*
“Did Cole reveal...?”
- Common ground
- Information structure
- Information about the speaker
- Prior beliefs

(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)

At-issueness

Every utterance gives rise to multiple contents.

- One of them is **at-issue**, i.e., the main point.
- The other ones are **not-at-issue**, i.e., secondary content.

(e.g., Chierchia & McConnel-Ginet 1990, Potts 2006)

(1) Ben: *My brother, who speaks Italian, is at the pizzeria.*

↪ the brother speaks Italian (C1)

↪ the brother is at the pizzeria (C2)

Direct assent diagnostic for at-issueness (declaratives)

(2) Alex: *Yes, (that's true,) he's at the pizzeria.*

(2) is acceptable, C2 is at-issue

(3) Alex: *Yes, (that's true,) he speaks Italian.*

(3) is unacceptable, C1 is not-at-issue

(e.g., Faller 2002; Potts 2007; Amaral et al 2007; Tonhauser 2012; Murray 2014; Syrett & Koev 2015)

At-issueness

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(1') Ben: *Is my brother, who speaks Italian, at the pizzeria?*

the brother speaks Italian (C1)

the brother is at the pizzeria (C2)

Q/A diagnostic for at-issueness (interrogatives)

(2) Alex: *Yes, he is.*

(2) is acceptable, C2 is at-issue

(3) Alex: *Yes, he does.*

(3) is unacceptable, C1 is not-at-issue

(e.g., Faller 2002; Potts 2007; Amaral et al 2007; Tonhauser 2012; Murray 2014; Syrett & Koev 2015)

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On diagnostics for not-at-issue content

- Diagnostics for not-at-issue content rely on different assumptions about at-issueness:
 1. Q/A diagnostic for interrogatives: the at-issue content of the Q partitions the context set (what is the Q asking?); not-at-issue content does not.
 2. Direct assent diagnostic: at-issue content can be targeted by an assent (“yes, *true*”) or a combination of an assent and a propositional anaphor (“yes, *that’s true*”); not-at-issue content cannot.
- There is some discussion about whether these diagnostics track the same property of utterance content, and how these diagnostics relate to different theoretical conceptions of at-issueness: e.g., Snider 2017, Koev 2018, Tonhauser et al 2018, Korotkova 2020.

On the direct assent diagnostic

- Snider 2017 and Korotkova 2020 proposed that being targeted by a propositional anaphor (“yes, *that’s true*”) does not track at-issueness, but availability for anaphoric reference; though see Koev 2018.

(1) [Mark is a high school teacher. His parents come to visit during a school assembly. His father is looking around the auditorium, curious about Mark’s students.]

Dad: Where are Mark’s students sitting?

Mom: Lisa, who is Mark’s favorite, is sitting in the front row.

He told me that in confidence, though, so don’t tell anyone.

(Snider 2017: 259)

- Investigations of the Gradient Projection Principle must confront the question of how at-issueness is defined and diagnosed.

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Tonhauser, Beaver & Degen 2018 (Exp 1b)

Pat: *“Did Cole discover that Raul was drinking tea?”*

12 factive predicates: *discover, find out, be annoyed, be amused, be aware, realize, learn, notice, see, establish, confess, reveal*

2 blocks (in random order)

- projection block: “certain that” diagnostic
- at-issueness block: Q/A diagnostic (“asking whether”)

Each participant rated the projection and at-issueness of 12 CCs (paired with a unique predicate) and 8 main clause contents.

Projection block: “certain that” diagnostic

interrogative
utterance

Ronald asks: "*Is Andrew amused that Kate fell from her horse?*"

response
question

Is Ronald certain that Kate fell from her horse?

response
slider

no

yes

Next

At-issueness block: Q/A diagnostic for interrogatives

same
interrogative
utterance

response
question

response
slider

Ronald asks: "*Is Andrew amused that Kate fell from her horse?*"

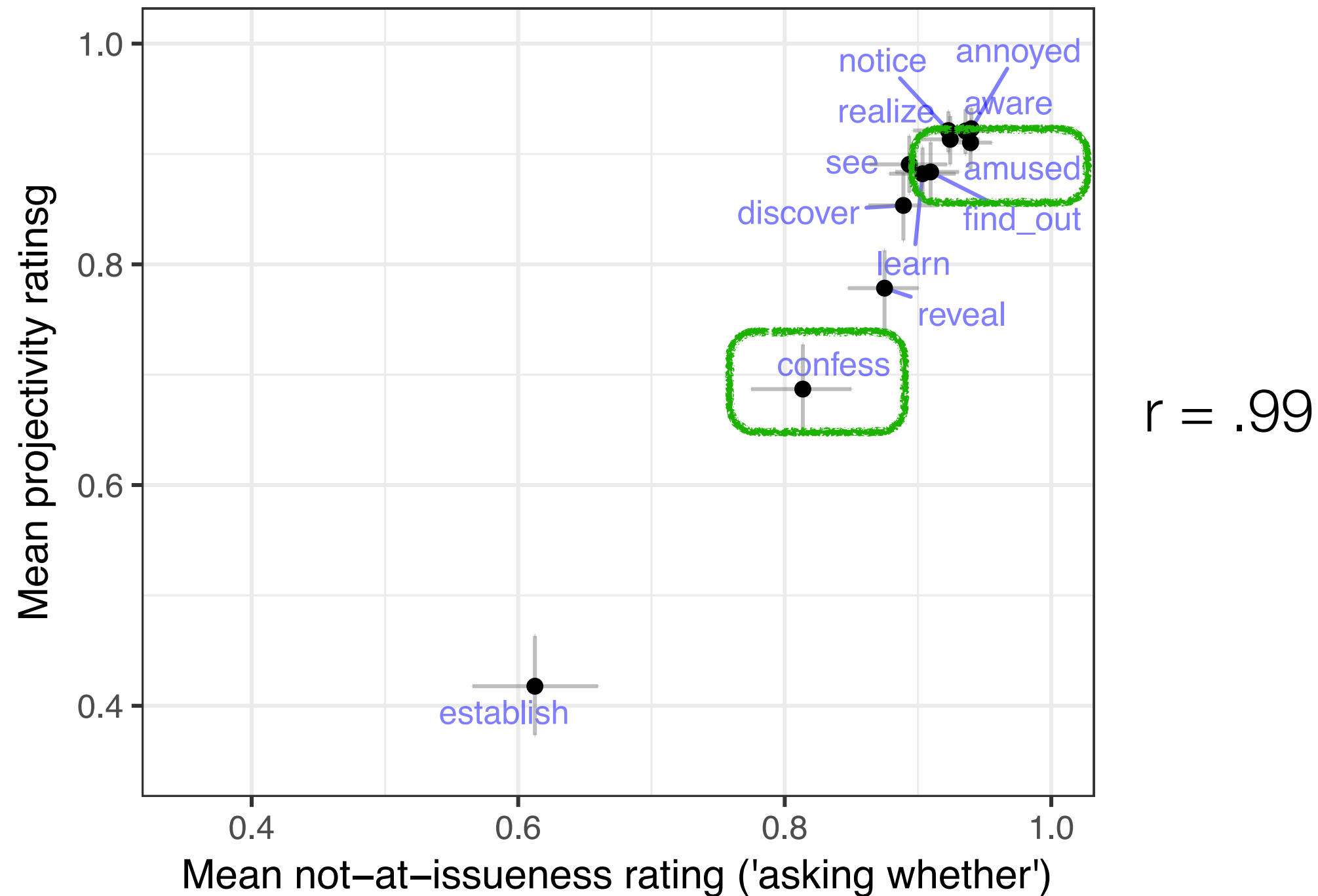
Is Ronald asking whether Kate fell from her horse?

no

yes

Next

Not-at-issueness (Q/A diagnostic) predicts projection



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Three experiments (Exps 1-3)

The goal of Exps 1-3 was to further investigate the GPP.

	Tonhauser et al 2018 Exp 1b	Exp 1	Exp 2	Exp 3
predicates	factive	factive and non-factive		
embedding	polar interr.	polar interr.	polar interr.	negation
at-issueness diagnostic	Q/A interr. (asking whether)	Q/A interr. (asking whether)	Q/A interr. (yes, <i>p</i>)	assent
projection diagnostic	certain that	certain that		

20 factive and non-factive clause-embedding predicates

(de Marneffe et al 2019; Tonhauser & Degen under re-review; Degen & Tonhauser 2021)

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

+ 20 embedded clauses = 400 predicate/clause combinations

Pat: “*Does Cole know that Julian dances salsa?*” (Exps 1-2)

Pat: “*Cole doesn’t know that Julian dances salsa.*” (Exp 3)

Procedure

2 blocks (in random order). Participants rated 20 CC/predicate combinations:

- projection block: “certain that” diagnostic
- not-at-issueness block: different diagnostics across Exps 1-3

Exps 1-2

Christina: *"Did Cole reveal that Julian dances salsa?"*

Is Christina certain that Julian dances salsa?

no yes

Next

Exp 3

Larry: *"Cole doesn't think that Julian dances salsa."*

Is Larry certain that Julian dances salsa?

no yes

Next

Not-at-issueness block (Exp 1: Q/A diagnostic, asking whether)

inter-
rogative



Elizabeth asks: "*Did Cole see that Julian dances salsa?*"

response
question

Is Elizabeth asking whether Julian dances salsa?

response

no

yes

Next

Not-at-issueness block (Exp 2: Q/A (yes, *p*) diagnostic)

inter-
rogative



Christina: *"Did Cole reveal that Julian dances salsa?"*
David: *"Yes, Julian dances salsa."*



assent
with CC

response
question

Does David's response to Christina sound good?

response

no

yes

Next

Not-at-issueness block (Exp 3: assent diagnostic)

negated
declarative

Larry: *"Cole doesn't think that Julian dances salsa."*
Melissa: *"Yes, that's true, Julian dances salsa."*

assent
with CC

response
question

Does Melissa's response to Larry sound good?

response

no

yes

Next

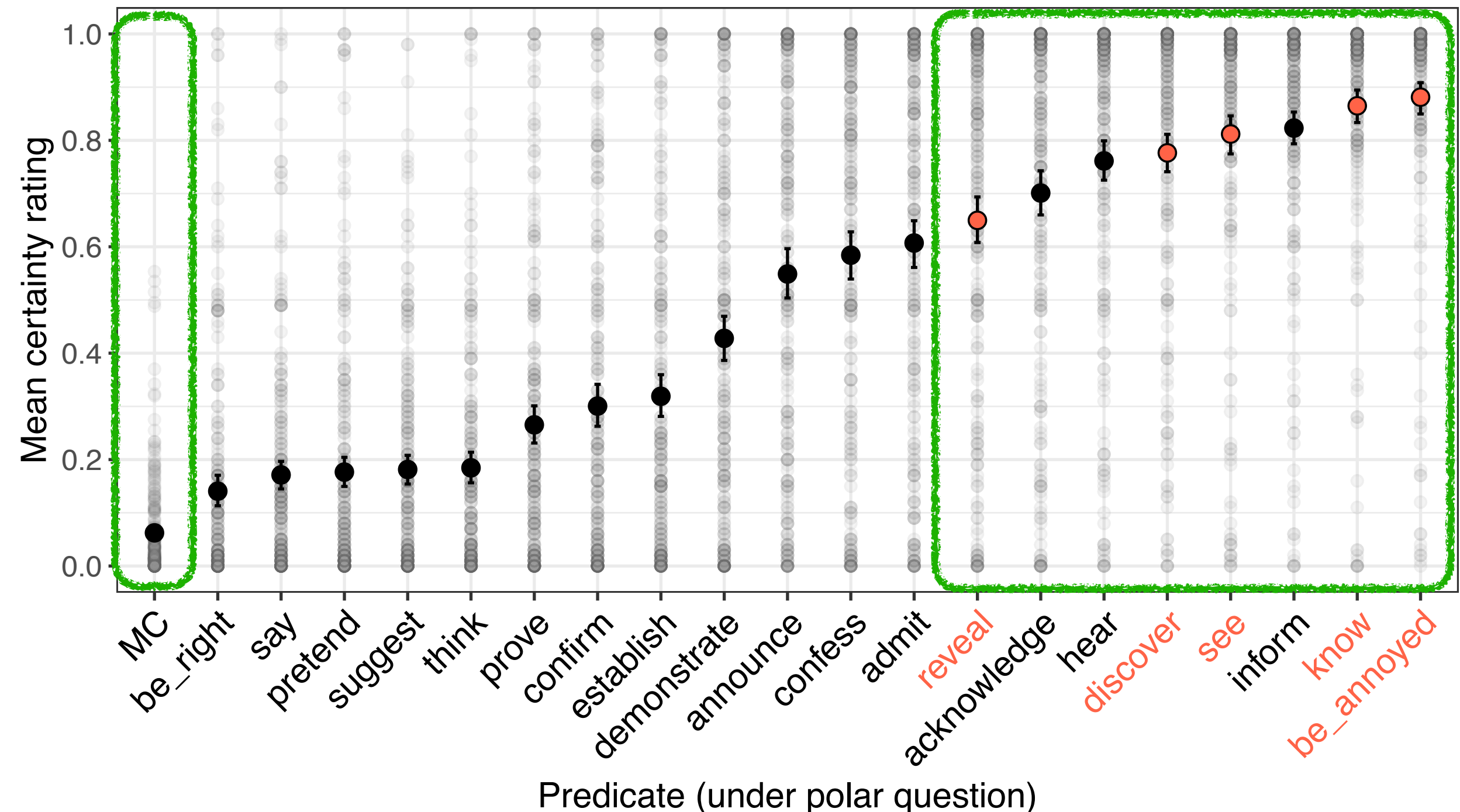
Results

1. How well do the **projection** ratings compare across the polar question embedding (Exps 1-2) and the negation embedding (Exp 3)?
2. How well do the **not-at-issueness** ratings compare across the Q/A “asking whether” diagnostic (Exp 1), the Q/A “yes, p ” diagnostic (Exp 2), and the assent diagnostic (Exp 3)?
3. Does not-at-issueness predict projection, as expected under the **Gradient Projection Principle**?

Projection ratings in Exp 1 (polar Q)

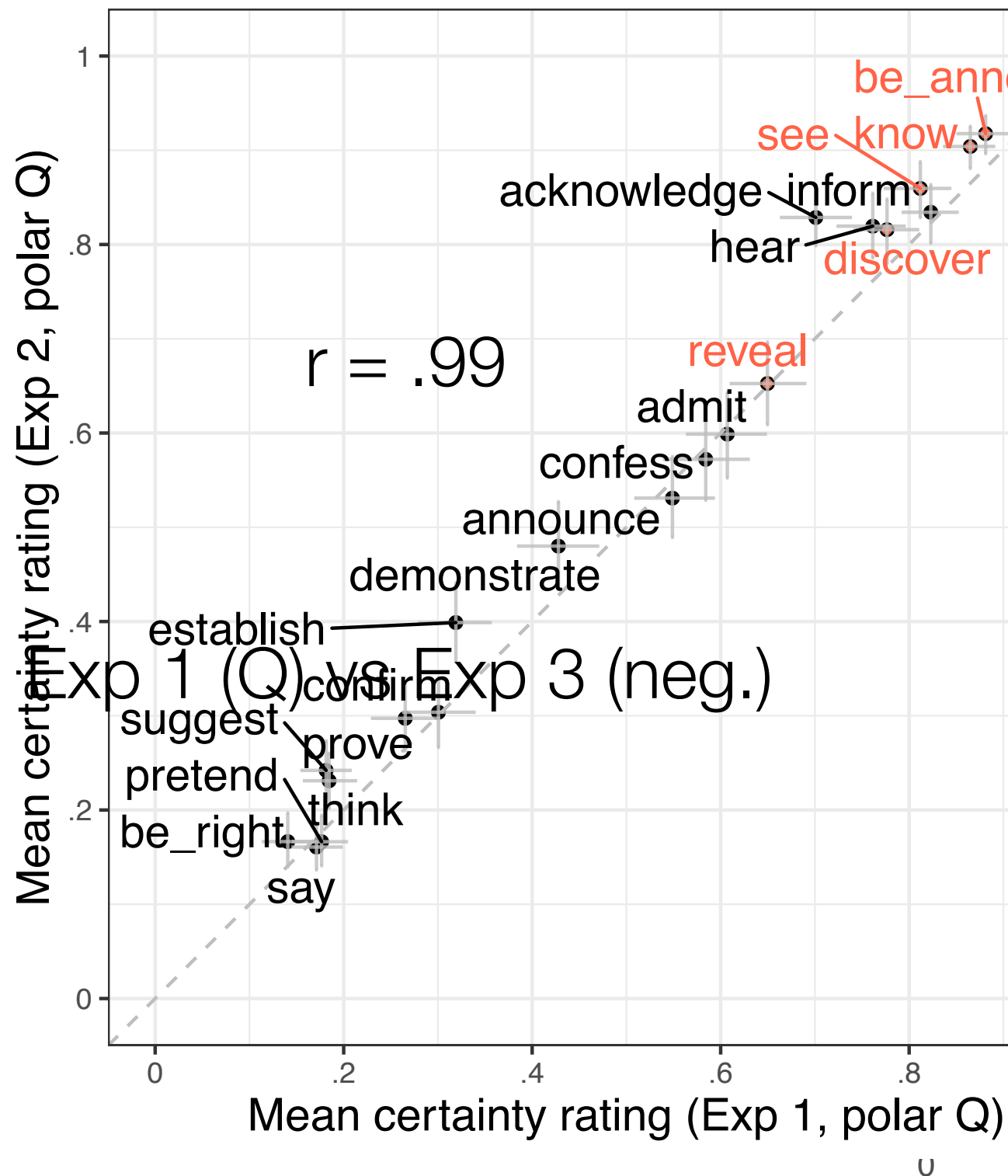
no categorical divide between factive and non-factive predicates,
see also Tonhauser & Degen (ms), Degen & Tonhauser 2021

(242 self-declared native speakers of American English)



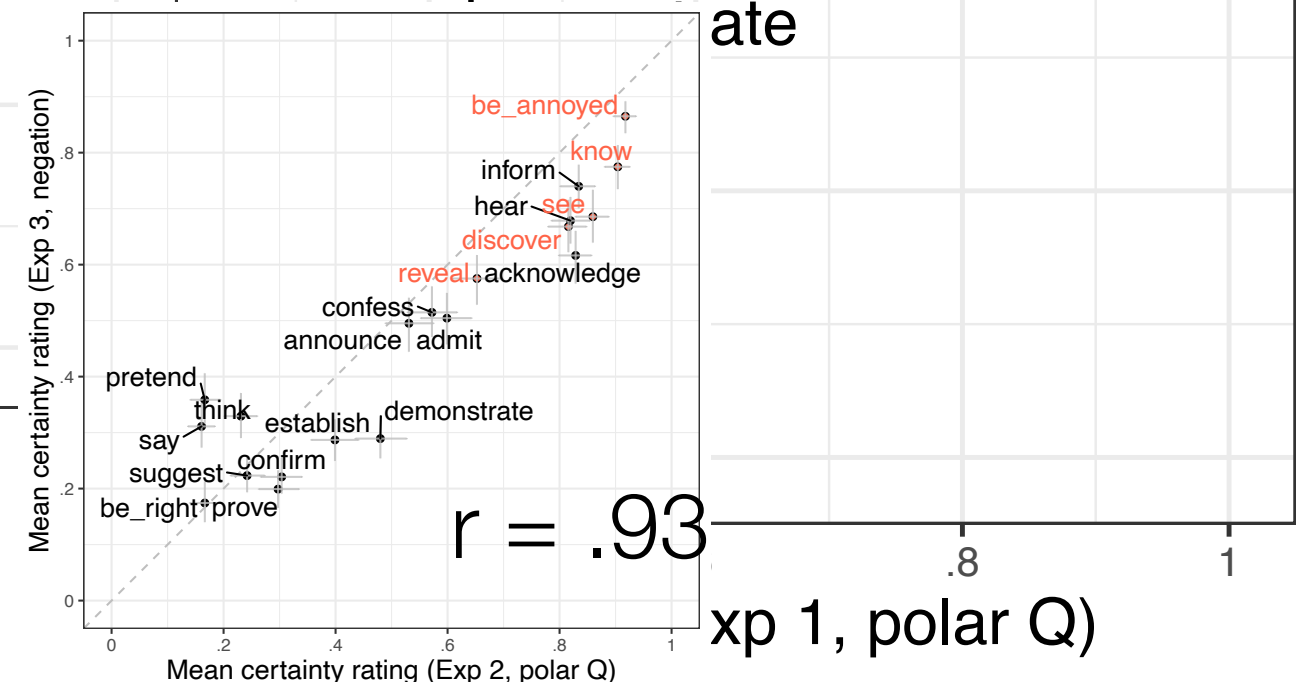
Projection ratings: High correlations across embeddings

Exp 1 vs Exp 2 (both polar Q)



- high correlations as expected, given semantic literature
- further replication of absence of categorical divide between factive and non-factive predicates

Exp 2 (Q) vs Exp 3 (neg.)



Results

1. How well do the **projection** ratings compare across the polar question embedding (Exps 1-2) and the negation embedding (Exp 3)?

No projection variation between question and negation embeddings.

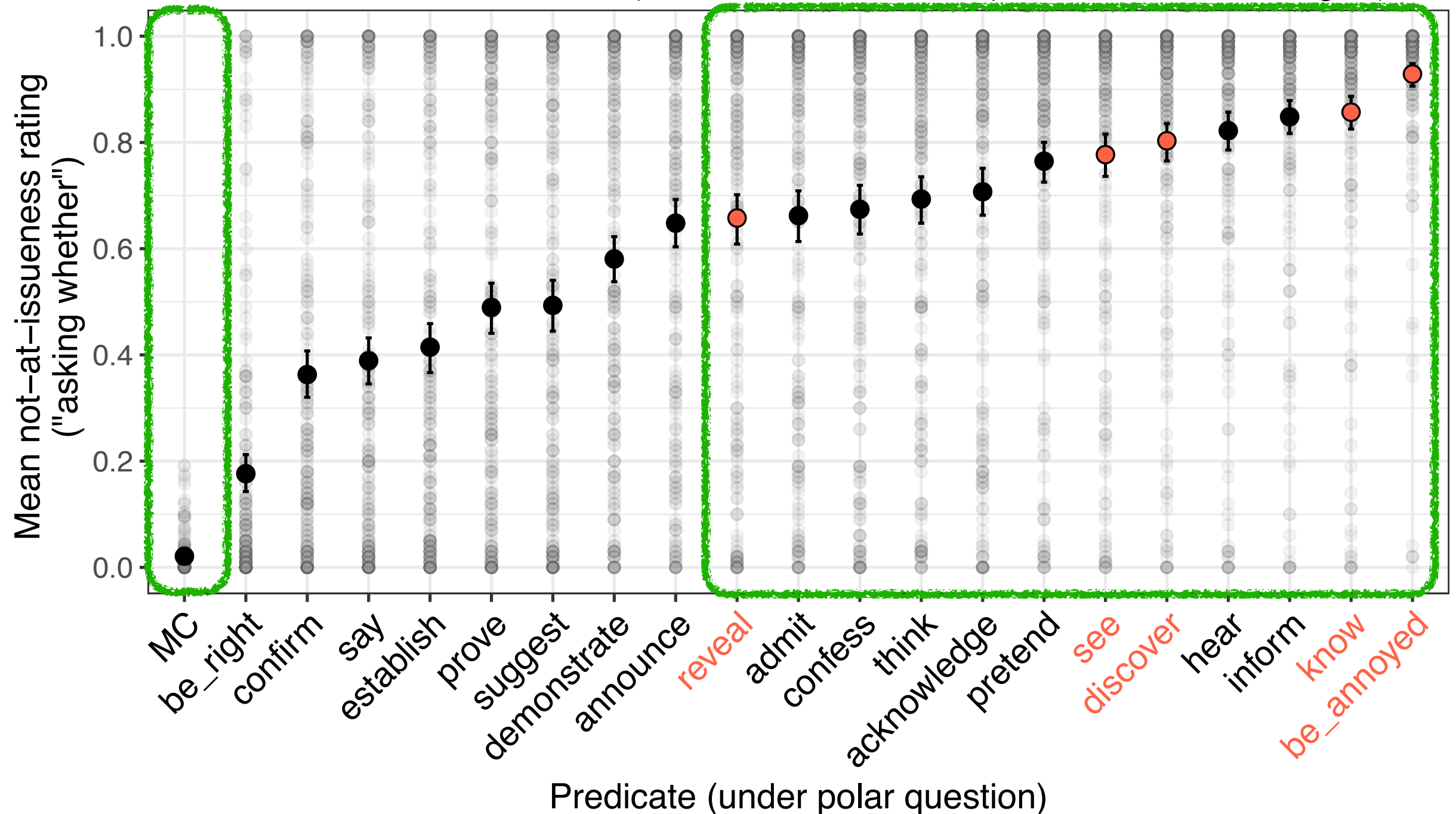
2. How well do the **not-at-issueness** ratings compare across the asking whether diagnostic (Exp 1), the question/answer diagnostic (Exp 2), and the assent diagnostic (Exp 3)?

3. Does not-at-issueness predict projection, as expected under the **Gradient Projection Principle**?

Not-at-issue ratings in Exp 1 (polar Q, “asking whether”)

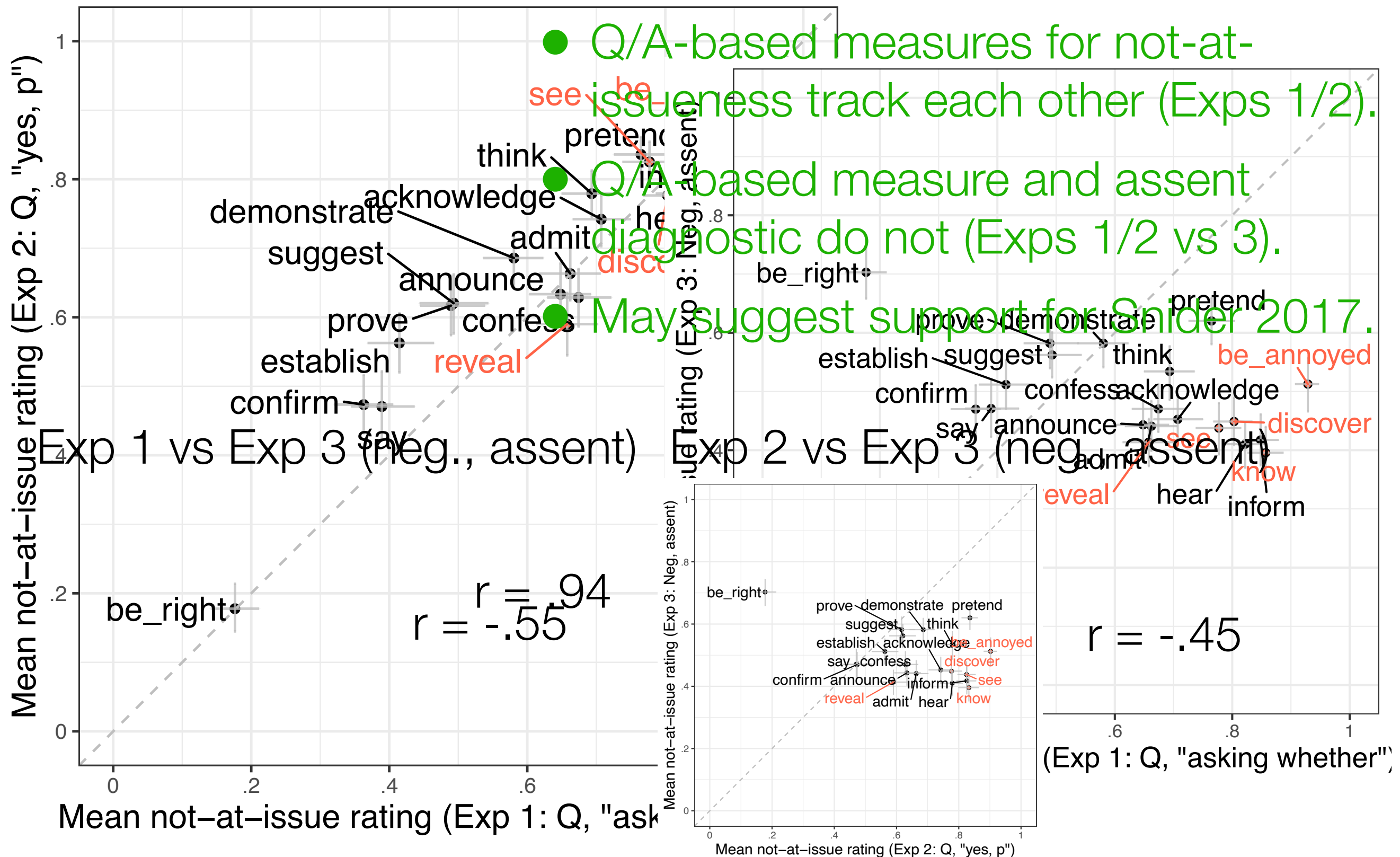
Gradience in not-at-issueness, as in Tonhauser et al 2018.

(242 self-declared native speakers of American English)



Comparing not-at-issueneess ratings across Exps 1-3

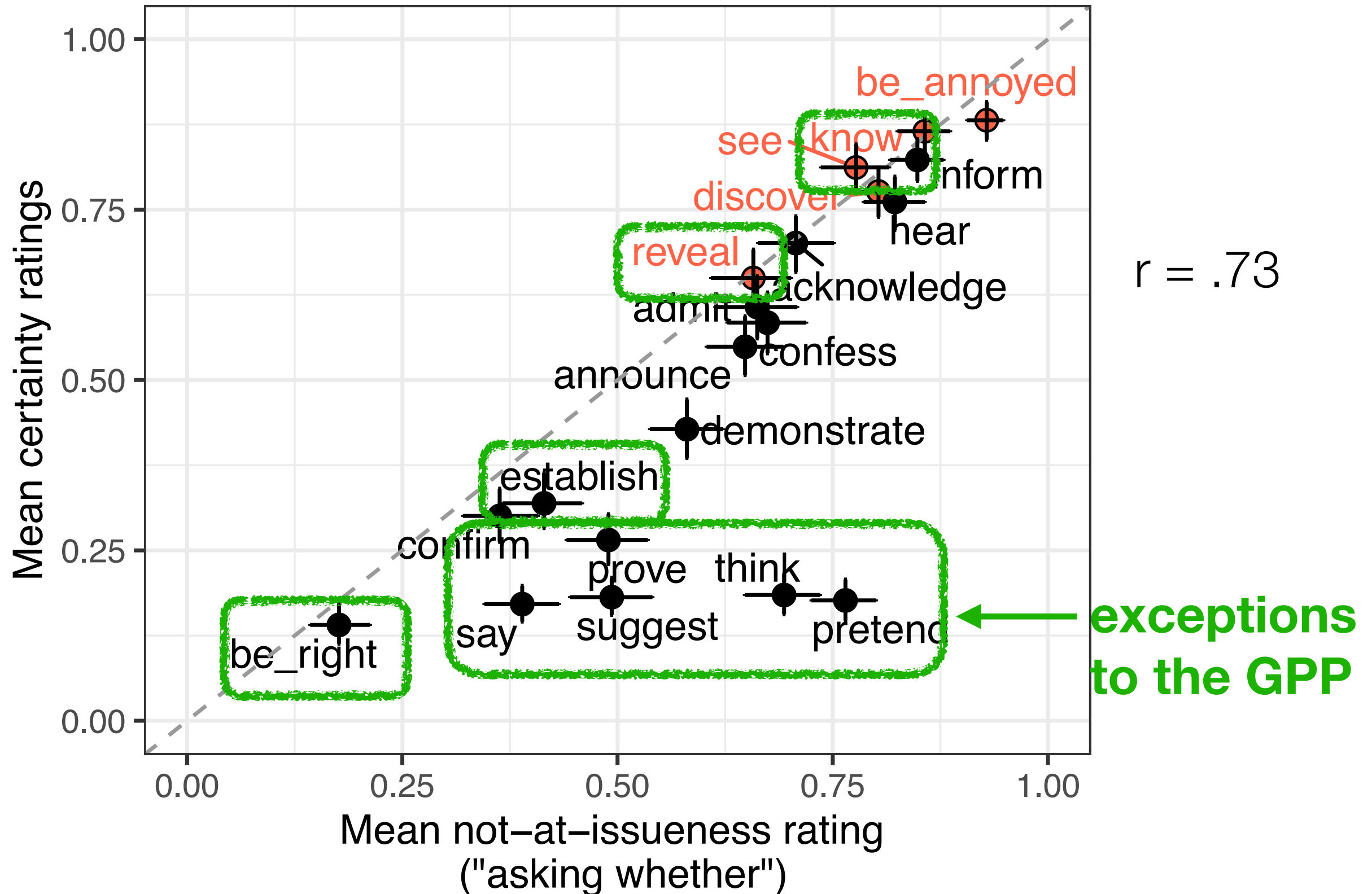
Exp 1 (Q, “asking whether”) vs Exp 2 (Q, “yes, p ”)



Results

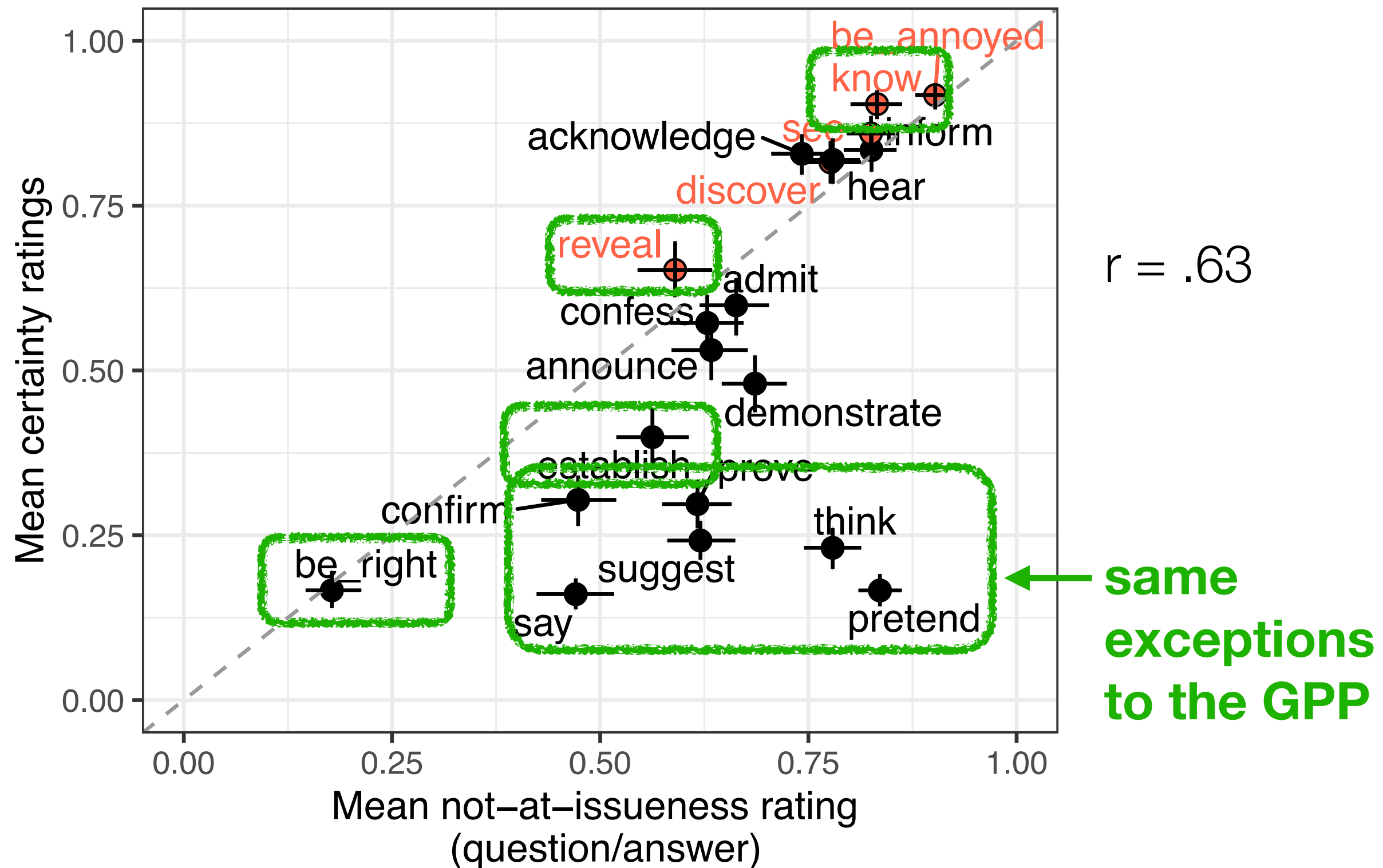
1. How well do the **projection** ratings compare across the polar question embedding (Exps 1-2) and the negation embedding (Exp 3)?
No projection variation between question and negation embeddings.
2. How well do the **not-at-issueness** ratings compare across the asking whether diagnostic (Exp 1), the question/answer diagnostic (Exp 2), and the assent diagnostic (Exp 3)?
Q/A-measures track each other, in contrast to assent measure.
3. Does not-at-issueness predict projection, as expected under the **Gradient Projection Principle**?

Exp 1 (Q, “asking whether”): At-issueness predicts projection



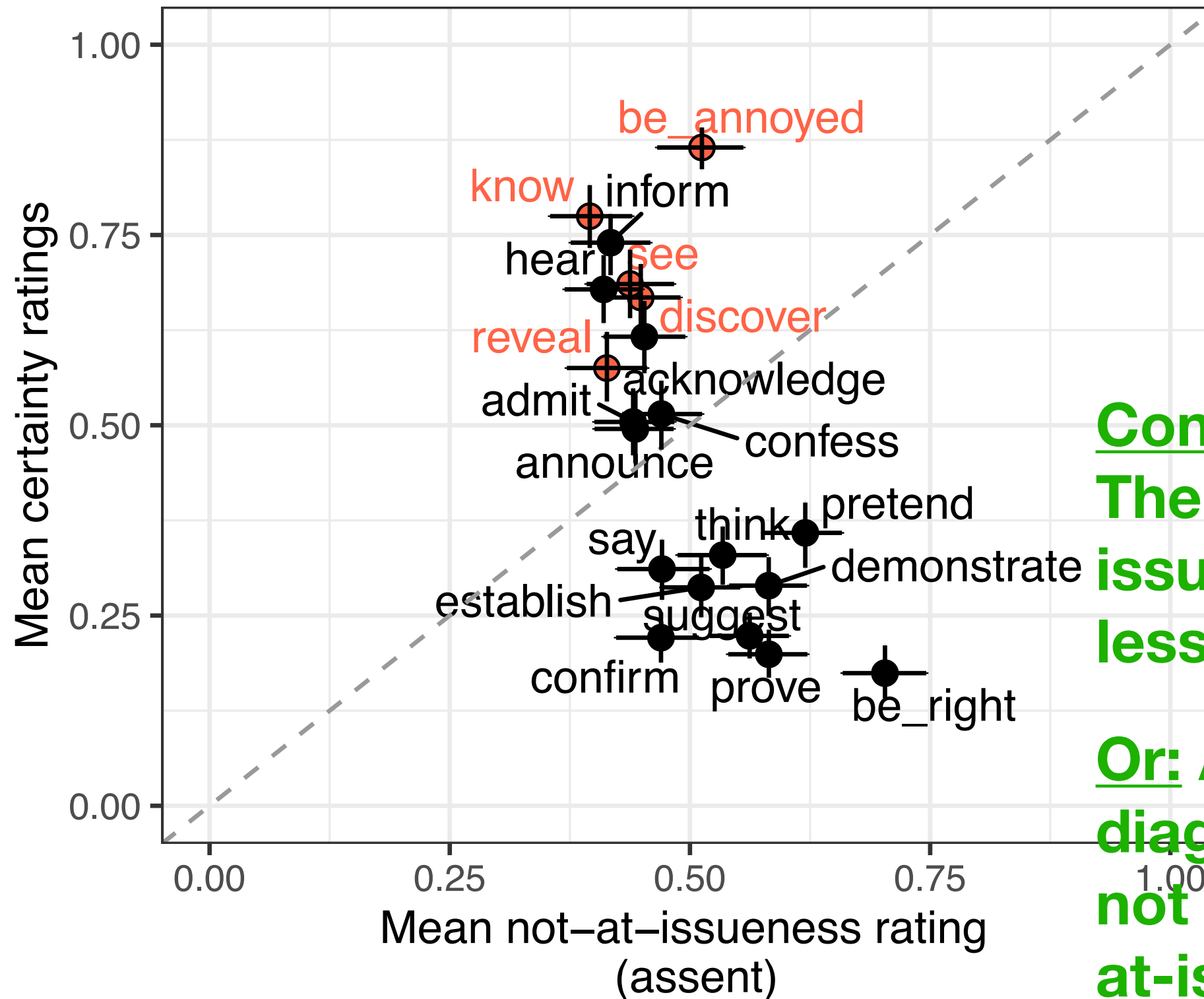
LMEM predicting certainty from asking whether ratings, RE for participant, CC, and predicate, slopes for asking whether (beta=0.21, SE=0.03 29.94984, t=7.1, p<.0001)

Exp 2 (Q, “yes, *p*”): At-issueness predicts projection



LMEM predicting certainty from asking whether ratings, RE for participant, CC, and predicate, slopes for asking whether (beta=0.08, SE=0.03, t=3, p<.01)

Exp 3 (neg, assent): At-issueness does not predict projection



Contrary to GPP:
The more not-at-issue the CC, the less it projects.

Or: Assent
diagnostic does not measure not-at-issueness.

LMEM predicting certainty from asking whether ratings, RE for participant, CC, and predicate, slopes for asking whether (beta=-.11, SE=.03, t=-4.5, p<.0001)

Summary of results

1. How well do the **projection** ratings compare across the polar question embedding (Exps 1-2) and the negation embedding (Exp 3)?

No projection variation between question and negation embeddings.

2. How well do the **not-at-issueness** ratings compare across the asking whether diagnostic (Exp 1), the question/answer diagnostic (Exp 2), and the direct assent diagnostic (Exp 3)?

Q/A-diagnostics track each other, in contrast to assent diagnostic.

3. Does not-at-issueness predict projection, as expected under the **Gradient Projection Principle**?

Yes, in Exp 1 (Q, “asking whether”) and Exp 2 (Q, “yes, p ”).

But not in Exp 3, where not-at-issueness was measured with the assent diagnostic.

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Concluding remarks

- This talk presented results that provide further support for Tonhauser et al's 2018 Gradient Projection Principle, according to which content projects to the extent that it is not-at-issue:
 - GPP holds across factive and non-factive predicates
 - Not-at-issueness measured in two different ways (Exps 1, 2)
- We've also seen systematic exceptions to the GPP from predicates like *say*, *suggest*, *think*, and *pretend*: their CCs projected less than their not-at-issueness predicted.

This result motivates systematic investigations of the role of lexical meaning in projection and at-issueness.

Concluding remarks

- This talk presented results that provide further support for Tonhauser et al's 2018 Gradient Projection Principle, according to which content projects to the extent that it is not-at-issue:
 - GPP holds across factive and non-factive predicates
 - Not-at-issueness measured in two different ways (Exps 1, 2)
- Exp 3 did not provide support for the GPP, but it did provide support for Snider's 2017 proposal that availability for anaphoric reference does not track at-issueness.

This result further emphasizes the need to empirically assess different diagnostics for at-issueness as well as theoretical proposals of at-issueness.