

On the information-structure sensitivity of projective content

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Projective content

Projective content is utterance content that listeners take speakers to be committed to even when the expression that contributes the content occurs in an entailment-canceling environment.

(1) Is Sam visiting Barcelona again? [*again* utterance]

↪ Sam has visited Barcelona before

(2) Did Sam shout WILDLY? [manner adverb utterance]

↪ Sam has been shouting

Big question: Why does projective content project?

Lexicalist projection analyses for *again* utterances

(e.g., Heim 1983, van der Sandt 1992, Blutner and Jäger 2003, Beck 2006, Abrusán 2013)

(1) Is Sam visiting Barcelona again?

again introduces an anaphoric definedness constraint, i.e., a presupposition:

(3) $again(p)(t)$ presupposes $p(t')$ where $t' \prec t$

(1) is defined iff Sam has visited Barcelona before. If defined, (1) asks whether Sam is visiting Barcelona right now.

Predictions of these analyses:

- The projectivity of the prejacent of *again* is at ceiling (“hard trigger”, no contextual suspension).
- Projectivity is not sensitive to information-structural focus.

Paraguayan Guaraní (Tupí-Guaraní)

- (4) Context: I introduce my friend José to you.

Kóva che-angiru José. # O-visita **jey** chéve.
this my-friend Jose 3-visit again me

‘This is my friend Jose. # He is visiting me **again**.’

- (5) Context: ...who you know visited me last year.

Kóva che-angiru José. O-visita **jey** chéve.
this my-friend Jose 3-visit again me

‘This is my friend Jose. He is visiting me **again**.’

This minimal pair shows that Guaraní *jey* ‘again’ and English *again* are associated with an anaphoric definedness constraint.

(Strong Contextual Felicity constraint, Tonhauser et al. 2013; see also Tiemann et al. 2011, 2014)

Focus-based projection analyses for manner adverb utterances

(e.g., Simons 2001, Beaver 2010 [2002], Abrusán 2013, Beaver et al. 2017, Simons et al. 2017, Stevens et al. 2017)

(2) Did Sam shout *WILDLY*?

- Prosody provides a cue to *wildly* being an information-structural focus.
- Focus on *wildly* indicates (2) addresses a background question ‘How did Sam shout?’, which entails that Sam shouted.
- Interlocutors are taken to be committed to this background entailment, i.e., the prejacent projects.

Predictions of these analyses:

- Projectivity is sensitive to information-structural focus.
- The prejacent is not categorically projective.

Evidence for a focus-based analysis of projection

1. Reported intuition that projectivity depends on information-structural focus: (see Abrusán 2013 for syntactically-marked focus)

(6) Did SAM shout wildly?

2. No empirical evidence for an anaphoric definedness constraint:

(7) Context: I couldn't see Berit during my talk. After my talk, a friend tells me:
Berit was smiling ironically.

3. It is implausible to lexically specify projective content in the lexical entry of all manner adverbs and other verbal modifiers.

Lexicalist versus focus-based projection analyses

	lexicalist (<i>again</i>)	focus-based (manner adverbs)
1. Is lexical specification plausible?	yes	no
2. How projective is the content?	categorical	not categorical
3. Is projection sensitive to information-structural focus?	no	yes

(e.g., Beck 2006, Abrusán 2013, Abrusán 2013, Stevens et al. 2017)

Empirical gap: There is no experimental evidence comparing the projectivity or information-structure sensitivity of the projective content of *again* and of manner adverb utterances.

Deciding between projection analyses

For any given projective content, is a lexicalist or a focus-based analysis appropriate? (Or some other analysis?)

(8) Did Sam discover that it's currently raining?

↪ it's currently raining

(9) Did Sam stop admiring the Sagrada Familia?

↪ Sam has been admiring the Sagrada Familia

- Lexical specification of a presupposition (e.g., Heim 1983, van der Sandt 1992)
- Focus-based/-sensitive analyses (e.g., Abrusán 2011, 2016, Simons et al. 2017)
- Analyses based on lexically-specified alternatives (e.g., Abusch 2010, Romoli 2015)

Question: Does the projectivity and information-structure sensitivity of these projective contents motivate a lexicalist or a focus-based analysis? (Or some other analysis?)

This talk

Explore and compare properties of projective content to evaluate the empirical adequacy of different projection analyses.

- (1) Is Sam visiting Barcelona again? [lexicalist]
- (2) Did Sam shout WILDLY? [focus-based]
- (8) Did Sam discover that it's currently raining?
- (9) Did Sam stop admiring the Sagrada Familia?

Main findings:

1. Lexicalist projection is influenced by utterance prosody.
2. Focus-based projection interacts with general reasoning and conventional contributions to projection.

Upshot: Projection analyses need to incorporate information from multiple sources.

For any given projective content, is a lexicalist or a focus-based analysis appropriate? Or some other analysis?

1. Is there empirical evidence for lexical specification of the projective content of utterances with *stop* and clause-embedding predicates like *discover*?
2. What do experimental investigations of the projectivity and information-structure sensitivity of projective content reveal?
3. Discussion of the theoretical implications of the findings

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No empirical evidence for an anaphoric definedness constraint

(examples adapted from Tonhauser et al. 2013:80, see also Spenader 2002, 2003)

- (10) Context: Laura, who doesn't live with her parents, visits them and asks them to sit down with her because she has to tell them something:
Nd-a-je-droga-vé-i-ma.
NEG-I-REFL-drug-more-NEG-PERF
'I've **stopped** doing drugs.'
- (11) Context: A girl backs out of a driveway and hits Susi's car. A woman comes running out of the house, apologizes that her daughter hit Sus's car and says:
Ha'e **oi-kuaa** o-moĩ-va'erã=ha i-lénte
she 3-know 3-put-must=that her-glasses
o-maneja=ha-guã.
3-drive=that-PURP
'She **knows** that she has to use her glasses to drive.'

Lexical specification doesn't predict non-detachability

The projective content associated with 'stop' and clause-embedding predicates is non-detachable, intra- and cross-linguistically. (e.g., Levinson and Annamalai 1992, Simons 2001, Tonhauser et al. 2013, Tonhauser ms)

(12) Did Jane stop / quit / cease laughing?

(adapted from Simons 2001:435)

(13) Jáne=pa nd-o-puka-vé-i-ma?

Jane=Q NEG-3-laugh-more-NEG-PERF

'Did Jane stop laughing?'

(14) Sám=pa **o-topa** / **oi-kuaa** o-ky=ha?

Sam=Q 3-discover 3-know 3-rain=that

'Did Sam **discover** / Does Sam **know** that it's raining?'

For any given projective content, is a lexicalist or a focus-based analysis appropriate? Or some other analysis?

1. Is there empirical evidence for lexical specification of the projective content of utterances with *stop* and clause-embedding predicates?

yes *again* (lexicalist analysis)

no manner adverbs (focus-based analysis)

stop

clause-embedding predicates

2. What do experimental investigations of the projectivity and information-structure sensitivity of projective content reveal?
3. Discussion of the theoretical implications of the findings

- (15) Wenn Thomas wieder Sushi macht, hilft Maiko dabei.
'If Thomas again makes sushi, Maiko will help him.'

Question to participants:

Is it possible that Thomas hasn't made sushi before?

Findings:

	% 'no' responses
<i>wieder</i> 'again'	99%
<i>auch</i> 'too'	87%
<i>erfahren</i> 'find out'	52%
<i>wissen</i> 'know'	38%

The projective content associated with *wieder* 'again' is highly projective, as expected from lexicalist projection analyses.

English manner adverb utterances

(Stevens, de Marneffe, Speer, and Tonhauser 2017)

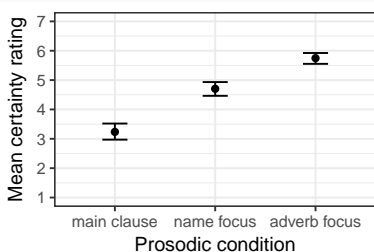
(16) Sally: Amanda didn't clap loudly.

1. L+H* L-L% [name focus]
2. L+H* L-L% [adverb focus]

Question to participants:

Is Sally certain that Amanda has clapped?

Findings:



Projectivity is not categorical and sensitive to focus.

English *stop* and clause-embedding predicates

(Tonhauser, Beaver, and Degen 2018)

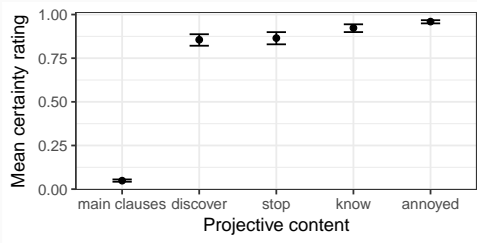
(17) Sally: Did Mary's daughter **stop** biting her nails?

(18) Sally: Did Sam **discover** / Does Sam **know** / Is Sam **annoyed**
...that Mary's daughter has been biting her nails?

Question to participants:

Is Sally certain that Mary's daughter has been biting her nails?

Findings:



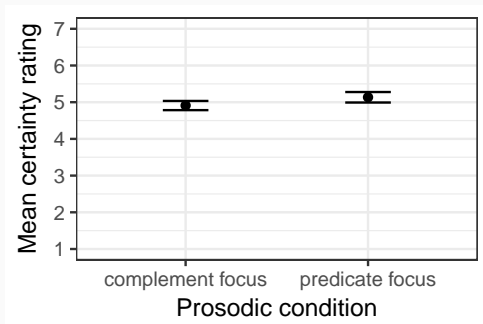
The content associated with *stop* and *discover* is less projective than that of *know* and *be annoyed*.

(19) Perhaps she knew that he was wrong.

1. H* L-L% [predicate foc]
2. L+H* L-L% [complement foc]

Question to participants: Is Sally certain that he was wrong?

Finding:



Projectivity is sensitive to prosodically-marked focus.

(see also Djärv and Bacovcin 2017)

Summary of available empirical evidence

2. What do experimental investigations of the projectivity and information-structure sensitivity of projective content reveal?

analysis		Categorical projectivity?	Focus-sensitivity?
lexicalist	<i>wieder</i> 'again'	yes	?
	<i>again</i>	?	?
focus	manner adverbs	no	yes
	clause-emb preds	yes/no	yes
	<i>stop</i>	no	?

Further short-comings of the available empirical evidence:

- No cross-content comparison
- Different response tasks

Comprehension experiment

With Marie-Catherine de Marneffe, Shari R. Speer and Jon Stevens

Research questions: How projective are different contents? Is their projectivity sensitive to prosodically-marked focus?

- (20) a. Did Alfie text again? [lexicalist]
 ~> Alfie texted before
- b. Did Alfie text secretly? [focus-based]
 ~> Alfie texted
- c. Did Alfie stop texting?
 ~> Alfie texted before

176 participants recruited on Amazon's Mechanical Turk platform

Same projective content across the three types of expressions

- (21) a. Did Alfie text again when Dan arrived?
 \rightsquigarrow Alfie texted before Dan arrived
- b. Did Alfie stop texting when Dan arrived?
 \rightsquigarrow Alfie texted before Dan arrived
- c. Did Alfie text secretly before Dan arrived?
 \rightsquigarrow Alfie texted before Dan arrived

Question to participants:

Is Sally certain that Alfie texted before Dan arrived?

Target sentences:

36 triples like (21), 3 for each of the 12 verbs (*text, smile, walk,...*)

108 sentences total

Spoken stimuli with prosodically-marked focus

4 prosodic conditions: L* pitch accent, H-H% boundary tone

Aux: DID Alfie text again when Dan arrived?

Play Sound

Subject: Did ALFIE text again when Dan arrived?

Play Sound

Verb: Did Alfie TEXT again when Dan arrived?

Play Sound

Target: Did Alfie text AGAIN when Dan arrived?

Play Sound

108 sentences x 4 prosodic conditions = 432 utterances

Prosodic variation was reduced by using the same temporal adjunct clause recording in each set of 4

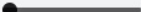
36 utterances per participant: 12 for each content type (*again*, *stop*, *manner*), 3 per prosodic condition (within-participant factors)

Procedure

Imagine that you are at a party. Upon walking into the kitchen, you overhear Debby, the party host, ask another guest a question.

Play Sound

Debby asks:

▶ 0:00 / 0:02  🔊

Is Debby certain that Annie cleaned before Pete arrived?

☐ **No, Debby is not certain** ☐ ☐ ☐ ☐ **Yes, Debby is certain**

Continue

Ordinal mixed effects models

- Predict certainty rating from content type / prosodic condition
- Random effects: participant, item, content
- Slope: participant

Results based on data from 126 participants (ages 21-76; mean: 36)

Data exclusion:

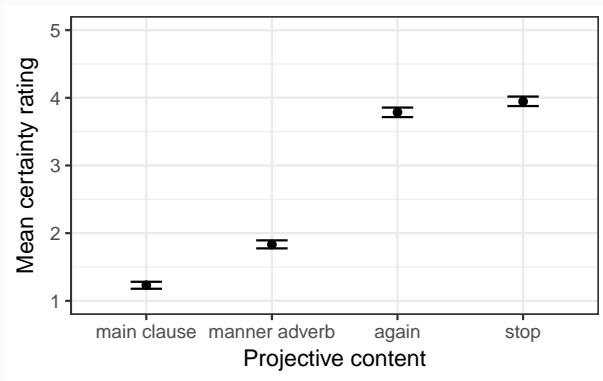
- 5 self-declared non-native speakers of American English
- 6 participants who always responded '1'
- 39 participants with response mean > 2 for the four main clause control stimuli (no change in findings if these data included)

Research questions

1. How projective are the projective contents?
2. Is projectivity sensitive to prosodically-marked information-structural focus?

How projective are the projective contents?

[1512 data points / target content, collapsing over the 4 prosodic conditions]



- ✓ Prejacent of manner adverb utterances is weakly projective.
- ✓ Prejacent of *again* utterances is much more projective.
- × The projectivity of none of the contents is at ceiling.
- × Pre-state of *stop* is more projective than prejacent of *again*.

Is projectivity sensitive to prosodically-marked focus?

Predictions of the focus-based projection analysis for the preadjacent of manner adverb utterances: (e.g., Abrusán 2013, Simons et al. 2017, Stevens et al. 2017)

1. Preadjacent is projective but not categorically so when the manner adverb is in focus

Target: Did Alfie text SECRETLY?

Background question: {Alfie texted x | x is a verb modifier }
entails: Alfie texted

2. Preadjacent is not projective when another expression is in focus

Subject: Did ALFIE text secretly?

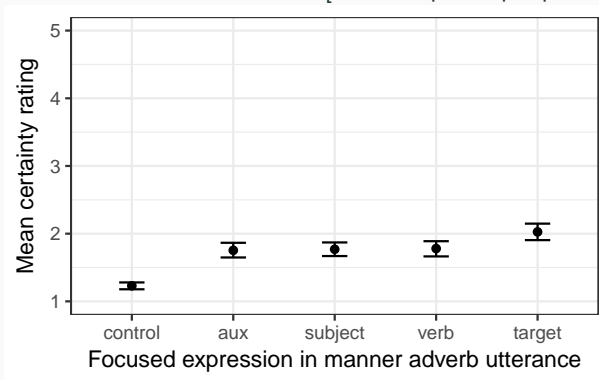
Background question: {x texted secretly | x an individual}
doesn't entail that Alfie texted

Aux: DID Alfie text secretly?

Verb: Did Alfie TEXT secretly?

Results: Prejacent of manner adverb utterances

[378 data points per prosodic condition]



✓ Prejacent is more projective with focus on the manner adverb.

× Prejacent is weakly projective in all prosodic conditions.

(see also Stevens et al. 2017)

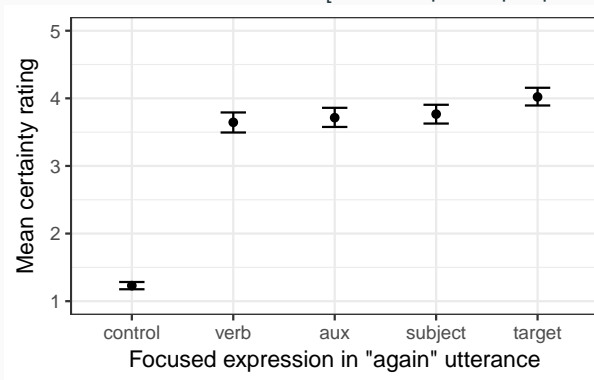
Is projectivity sensitive to prosodically-marked focus?

Prediction of the lexicalist projection analysis for the preajacent of *again* utterances: (e.g., Beck 2006, Abrusán 2013)

Projectivity of preajacent is at ceiling regardless of which expression is in focus.

Results: Prejacent of *again* utterances

[378 data points per prosodic condition]



- × Projectivity of prejacent of *again* utterances is not at ceiling.
- × Prejacent is more projective with focus on *again*.

Focus-sensitivity for pre-state of *stop* utterances

- **Default projection** (Abusch 2010, Abrusán 2011, 2016, Romoli 2015): pre-state projects by default (lexically specified alternatives, backgrounded entailment, obligatory scalar implicature), unless contextually defeated.

Predictions:

- Focus on *stop*: projectivity of pre-state at ceiling
- Focus elsewhere: pre-state less projective

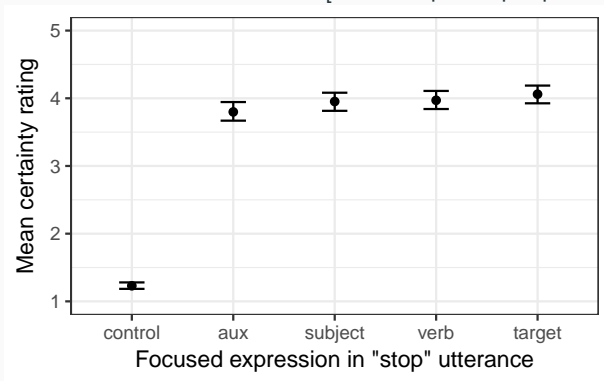
- **Focus-based projection** (e.g., Simons et al. 2017, Beaver et al. 2017):

Same predictions as for manner adverb utterances:

- Pre-state is projective but not categorically so with focus on *stop*
- Pre-state is not projective with focus on another expression

Results: Pre-state content of *stop*

[378 data points per prosodic condition]



- Projectivity of pre-state is high but not at ceiling. (neither theory)
- Pre-state content is more projective...
 - ...with focus on *stop* than on subject or auxiliary (both)
 - ...with focus on verb than on auxiliary (neither)

Summary of findings

Research questions: How projective are the contents and is their projectivity sensitive to prosodically-marked focus?

Projectivity:

- The projective content of manner adverb utterances is weakly projective, and that of *again* and *stop* utterance highly projective.
- The projectivity of the content of manner adverb utterances is never at floor, and that of *again* utterances is never at ceiling.

Sensitivity to prosodically-marked focus:

- The projectivity of all three types of projective content is sensitive to the prosodic manipulation.
- The sensitivity of *stop* utterances to the prosodic manipulation is more varied than for utterances with manner adverbs or *again*.

Discussion: Which projection analyses are appropriate?

General theme:

- Neither lexicalist nor focus-based analyses alone account for the findings.
- Empirically adequate projection analyses need to incorporate cues from multiple sources, including:
 - anaphoric definedness constraints
 - information structure
 - truth-conditional content
 - general reasoning and world knowledge
 - other information communicated by prosody

(see also Tonhauser, Beaver, and Degen 2018)

Discussion: Which projection analyses are appropriate?

Prejacent of manner adverb utterances: weakly projective even when manner adverb is not in focus.

- Focus-based analysis alone does not predict this finding.
- **Possible way forward:** General reasoning contributes to projectivity, i.e., what we take the speaker to be committed to.

For example:

(22) Berit wasn't smiling.

(23) Berit wasn't smiling ironically.

By uttering (23) rather than the simpler (22), the speaker is taken to be committed to Berit having smiled.

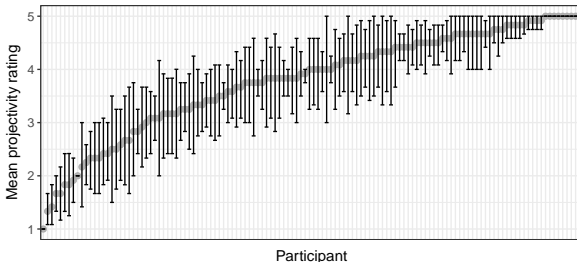
Focus on the manner adverb strengthens commitment.

Discussion: Which projection analyses are appropriate?

Prejacent of *again* utterances: projectivity was not at ceiling (mean: 3.79 / 5) and sensitive to prosodic condition.

Projectivity not being at ceiling contrasts with finding for *wieder* 'again' in Xue and Onea 2011

- 12 *again* items vs. 3 *wieder* 'again' items
- 126 participants vs. 34 participants
- Certainty judgment vs. possibility of prejacent being false
- 5-point Likert scale vs. binary response



Discussion: Which projection analyses are appropriate?

- No currently available analysis of *again* allows for the suspension of the prejacent of *again* utterances under any circumstances (“hard trigger”).
- Given evidence for anaphoric definedness constraint, we don’t want to give up on anaphoric analysis. (Tiemann et al. 2011, 2014 on *wieder*)
- **Avenue for future research:**
 - Prosody is a cue to focus but also conveys information about the speaker’s epistemic and emotional state, authority, stance towards the interlocutor, politeness, etc.
 - It is possible that this information interacts with how committed the speaker is taken to be, i.e., with the projectivity of the prejacent.

Discussion: Which projection analyses are appropriate?

Pre-state of *stop* utterances:

- Projectivity was not at ceiling, but higher than with manner adverb utterances.
- Projectivity was sensitive to prosodic condition in a more fine-grained fashion than expected on focus-based analyses.

Should the mean rating for *stop* utterances be considered the ceiling? (4.1 out of 5)

No: projectivity consisted with findings of Tonhauser et al. 2018.

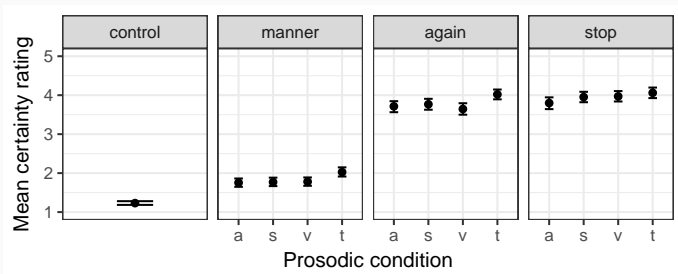
expression	mean rating
<i>stop</i>	.87
<i>know</i>	.92
<i>NRRC</i>	.95
<i>be annoyed</i>	.96

Discussion: Which projection analyses are appropriate?

Lexicalist or default projection analyses not empirically adequate:

- No empirical evidence for an anaphoric definedness constraint.
- Projectivity was not at ceiling.

Focus-based analysis alone is not empirically adequate either:



Proposal: Incorporate contribution from truth-conditional content of *stop* to projectivity. (see also Tonhauser et al. 2018)

Summary of theoretical implications

Research questions: Why does projective content project? For any given projective content, is a lexicalist or a focus-based analysis appropriate? (Or some other analysis?)

- Lexicalist and focus-based analyses do not adequately capture properties of projective contents they were designed for: *again* and manner adverb utterances, respectively.
- Likewise, the properties of the pre-state of *stop* utterances are not captured by any of the analyses currently on the market (lexicalist, focus-based, default-based).

Upshot: Projection analyses need to incorporate information from multiple sources.

Concluding remarks

Projective content is heterogeneous and different analyses have been proposed for subclasses.

Research over the past 50 years has revealed many factors that influence projectivity:

- anaphoric definedness constraints (e.g., Heim 1983, van der Sandt 1992)
- information structure (e.g., Beaver 2010, Tonhauser et al. 2018)
- truth-conditional content (e.g., Karttunen 1971, Tonhauser et al. 2018)
- world knowledge (e.g., Tonhauser et al. ms, Degen and Tonhauser ms)
- trustworthiness of attitude holder (e.g., Schlenker 2010, Spector and Egré 2015)
- information communicated by prosody

Avenues for future research:

- Develop and test analyses that incorporate information from multiple sources.
- Broaden empirical scope to less well-studied languages.

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