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Investigating the projection behavior of (non-)fatives

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## **Factivity, prosody, and at-issueness: Investigating the projection behavior of (non-)factives**

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Tonhauser et al. (2018) hypothesized in their Gradient Projection Principle (GPP) that content projects (i.e., is taken as a speaker commitment in entailment-cancelling environments) to the extent that it does not address – or is *not-at-issue* relative to – the Question Under Discussion (QUD). Consistent with the GPP, at-issueness and projection have been found to be correlated for contents expressed by the complements (CCs) of factive predicates, and prosodic cues to at-issueness (via sentential information structure) also influence the projection of factive CCs (Cummins & Rohde 2015, Tonhauser 2016, Djärv & Bacovcin 2020). However, prosodic cues to at-issueness appear not to have the same effect on the projection of non-factive CCs (Djärv & Bacovcin 2020, Mahler et al. 2019). This difference in behavior is consistent with the GPP if factivity is assumed to influence the at-issueness of the CC. We report on an experiment to test this assumption. Our work goes beyond prior experimental research by investigating the relation between at-issueness and projection for non-factive CCs, and explicitly measuring effects of prosody on at-issueness.

**At-issueness and CC projection with (non-)factives** Empirical support for the GPP primarily comes from experiments on factive presupposition projection. Using written constructed stimuli, Tonhauser et al. (2018) found that the at-issueness and projectivity of factive CCs were correlated, as predicted by the GPP: contents that were rated less at-issue were more projective, and vice versa. The GPP also predicts that whether content projects depends on whether it addresses a QUD that makes the content at-issue. Experiments demonstrating that prosody influences factive presupposition projection are consistent with this prediction, assuming that prosody constrains the QUD addressed by the utterance (Cummins & Rohde 2015, Tonhauser 2016, Djärv & Bacovcin 2020). The findings of these experiments suggest that factive CCs are less projective when a complement constituent receives narrow focus as in (1-a) than when it does not as in (1-b):

- (1) Martha (about Andrew and Rhonda): (adapted from Tonhauser et al. 2018)
- a. Did Andrew discover that [she]<sub>F</sub> visited the zoo? *complement subject focus*
  - b. Did Andrew [discover]<sub>F</sub> that she visited the zoo? *predicate focus*
  - c. Did Andrew discover that [she visited the zoo?]<sub>F</sub>? *whole complement focus*

If narrow focus within the complement (i.e., (1-a)) implicates a QUD in which the CC is at-issue (e.g., *Who visited the zoo?*) and absence of narrow complement focus (i.e., (1-b)) implicates a QUD in which the CC is not-at-issue (e.g., *What's the speaker's relation to the CC that Rhonda visited the zoo?*), these findings are predicted by the GPP. Whether the GPP also explains the projection behavior of contents associated with non-factive predicates is unclear. To our knowledge, there are only two experimental studies that bear on this question. In an experiment with constructed stimuli, Djärv & Bacovcin (2020) found that non-factive CCs in the complement subject focus condition were *more* projective than those in the predicate focus condition. Using naturally-occurring utterances, Mahler et al. (2019) found no effect of prosody on the projection of non-factive CCs. The current study adds to the experimental literature on CC projection by explicitly testing for prosodic effects on at-issueness (not only the QUD), and exploring whether these effects are constrained by the factivity of the embedding predicates. In particular, we aim to determine whether differences in at-issueness due to factivity constrain the effect of prosody on projection behavior.

**Experiment** We conducted an experiment on Prolific, adapted from Tonhauser et al. (2018).

**Materials:** The stimuli were spoken versions of Tonhauser et al.'s (2018) written stimuli, adapted for the purposes of the experiment. Each target sentence featured a clause-embedding predicate (*be right, say, believe, discover, know, realize*) and a clausal complement instantiated by 6 different lexical contents (2 per predicate). A ToBI trained speaker recorded the target sentences in 3 prosodic conditions: narrow focus on the complement subject (1-a), narrow focus on the predicate (1-b), and focus over the entire complement (1-c). 3 control stimuli were also included.

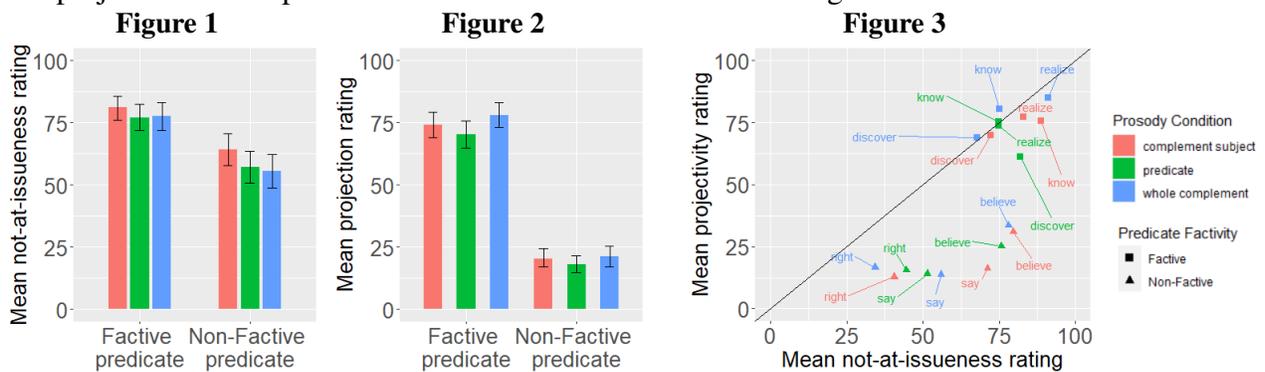
**Procedure:** Participants were assigned 6 target stimuli (2 in each prosodic condition) and 3 control stimuli. The same stimuli were presented to each participant in two blocks: an at-issueness block

and a projection block. After listening to target sentences in the at-issuiness block, participants indicated whether the speaker is asking about the CC, e.g., *Is Martha asking whether Rhonda visited the zoo?*. In the projection block, participants indicated whether the speaker was certain about the truth of the CC e.g., *Is Martha certain that Rhonda visited the zoo?*. Participants responded by using a slider labeled from “no” to “yes”. Higher ratings were assumed to indicate that the CC is more at-issue (in the at-issuiness block) and more projective (in the projection block).

**Results & Discussion** We expected not-at-issuiness to be predicted by an interaction between prosody and factivity, with prosody influencing not-at-issuiness for factive predicates only. Contrary to this expectation, a linear mixed-effects model predicting not-at-issuiness ratings (transformed from the at-issuiness ratings) from factivity, prosody, and their interaction revealed that the interaction was not significant. However, factivity and prosody were significant main effects. As illustrated in Figure 1, CCs of factive predicates were more not-at-issue than those of non-factive predicates. CCs were also more not-at-issue in the predicate focus condition than the other two conditions. A separate model in which the individual predicate was used as a predictor (rather than predicate factivity) confirmed the absence of an interaction between predicate and prosody.

We also expected projection to be predicted by an interaction between prosody and factivity, with prosody influencing the projection of factive predicates only. Contrary to this expectation, a linear mixed-effect model predicting projection ratings from fixed effects of factivity, prosody, and their interaction revealed that the interaction was not significant. However, factivity and prosody were significant main effects. Consistent with standard assumptions about factivity, the CCs of factive predicates were found to be more projective than those of non-factives, as shown in Figure 2. There was also a significant main effect of prosody, such that CCs were more projective in the whole complement condition than the complement subject condition. This is, to our knowledge, a novel finding: previous experimental work has not explored how broad focus (i.e., focus over the entire complement) influences CC projection. Whether this effect replicates and how it can be accounted for are questions for future research. Finally, projection ratings in the predicate condition were not significantly higher than those in the complement subject condition, though the direction of the trend is expected given previous experimental findings.

The results also suggest that not-at-issuiness is a less robust predictor of projection for some predicates. As shown in Figure 3, not-at-issuiness and projection are highly correlated for the factive predicates *know*, *discover* and *realize* but the non-factive predicates *be right*, *say* and *believe* are less projective than expected based on their not-at-issuiness ratings.



Overall, these findings suggest that the at-issuiness of the CC is influenced by the factivity of the embedding predicate. However, differences in projection behavior are not straightforwardly predicted by these differences in at-issuiness. Our work therefore presents a challenge to the GPP, suggesting that the principle may not predict the projection behavior of non-factive CCs.

**Selected References** Tonhauser, Judith, David Beaver, and Judith Degen. 2018. How projective is projective content? Gradience in projectivity and at-issuiness. *Journal of Semantics*.

Mahler, Taylor, Marie-Catherine de Marneffe, Catherine Lai. 2019. The prosody of presupposition projection in naturally-occurring utterances. *Sinn und Bedeutung* 24.