Prior probabilities and the projectivity of entailed and non-entailed content

This paper provides experimental evidence from English utterances with clause-embedding predicates that i) the content of both entailed and non-entailed clausal complements may be projective, ii) the projectivity of entailed and non-entailed content is influenced by the prior probability of the event described by the clause, and iii) veridicality (the extent to which the clausal complement is entailed) is not a predictor of the projectivity of projective content. These findings challenge analyses of projective content that are limited to entailed content (e.g., **??**) and motivate analyses according to which listeners integrate multiple sources of information, some conventional and some non-conventional, in determining what speakers are committed to (e.g., **?????**).

Presuppositions versus non-entailed projective content

The content of the clausal complement in (1a), that Julian dances salsa, is 'projective': a speaker who utters one of the variants in (1a) may be taken to be committed to this content even though the clause occurs in a polar question (e.g., **?**). The question of how this content comes to be projective is traditionally given very different answers for *discover* vs. *announce*. Whereas the content of the complement of *discover* is typically taken to be projective because it is a presupposition (e.g., **??**), the content of the complement of *announce* is not analyzed as a presupposition because it is not entailed by the atomic sentence in (1b), in contrast to the content of the complement of *discover*. Thus, whereas *discover* is considered to be a factive predicate (i.e., it both entails and presupposes the content of its complement), *announce* is merely a "part-time trigger" (**?**:139) that gives rise to the "illusion of factivity" (**?**:76).

(1) a. Did Sandy {discover / announce} that Julian dances salsa?
b. Sandy {discovered / announced} that Julian dances salsa.

This paper provides experimental evidence that suggests that it is empirically inadequate to analyze the projectivity of entailed and non-entailed content in fundamentally different ways.

Factors that influence the projectivity of projective content

The projectivity of (entailed) projective content is variable (e.g., **???**) and influenced by several conventional and non-conventional factors, incl. syntax (e.g., **?**), context (e.g., **?**), prosody (e.g., **??**) and at-issueness (e.g., **?**). We examined the influence of two novel factors on the projectivity of the content of the clausal complements: the prior probability of the event described by the clausal complement and the veridicality of the clause-embedding predicate. Am. English-speaking participants were recruited on Amazon's Mechanical Turk platform.

Norming study #1 (n=68): We measured the prior probabilities of 20 events described by English clauses (e.g., *Julian dances salsa*) given one of two facts about the world for each event: one fact made the event more likely than the other fact (e.g., *Julian is Cuban* vs. *Julian is German*). The mean prior probability of the events was .7 (sd = .21) when presented with facts that made the events more likely and .16 (sd = .17) when presented with facts that make the events less likely.

Norming study #2 (n=271): Veridicality was defined as the extent to which sentences like (2) were judged to be contradictory (e.g., for (2): Is Carol's utterance contradictory?). Responses were given on a sliding scale from 'definitely no' to 'definitely yes'.

(2) **Carol:** Sandra {discovered / announced / suggested} that Julian dances salsa, but he doesn't.

The veridicality of 20 clause-embedding predicates was tested: 7 are typically taken to entail the content of the complement (E: *be annoyed, know, discover, reveal, see, establish, be right*), 5 are typically taken to not entail the content of the complement (NE: *pretend, think suggest,*

say, hear), and the remaining 8 are typically taken to not entail the content of the complement even though they may sometimes appear to (V: *prove, demonstrate, confess, inform, announce, acknowledge, admit, confirm*); see e.g., **???**. Each predicate was paired with the 20 clauses that describe the aforementioned events. As shown in Fig. 1, predicates in the NE class are least veridical, as expected, but predicates in the E class are not uniformly highly veridical and instead form a veridicality gradient with predicates in the V class.

Experiment: Projectivity

This experiment explored the influence of prior probability and veridicality on the projectivity of the contents of clausal complements. Of the 20 predicates, 7 are typically taken to be factive (*be annoyed, know, discover, reveal, see, hear, inform*), 7 are typically taken to not be factive (*be right, pretend, think, suggest, say, prove, demonstrate*), and the remaining 6 predicates have been suggested to be "part-time triggers" or to give rise to the "illusion of factivity" (*establish, confess, announce, acknowledge, admit, confirm*; see references above).

Materials and procedure. Polar questions were formed from one of the 20 predicates paired with one of the 20 event-describing complement clauses. Participants were presented with 20 polar questions (one for each predicate), uttered by a named speaker, as shown in (3). Each polar question was presented with one of the two facts for the event described by clausal complement. Participants were asked to assess whether the speaker was certain of the content of the clausal complement (e.g., *Is Carol certain that Julian dances salsa?*) and gave their responses on a sliding scale from 'no' to 'yes'.

(3) **Fact (which Carol knows):** Julian is German.
Carol: Did Sandra {discover / announce / suggest} that Julian dances salsa?

Results (n=253) and discussion. Mean projectivity ratings are shown in Fig. 2. Replicating **?**, we observe a large degree of variability in projectivity across predicates. Clausal complements that describe a priori more likely events (given the presented fact), were judged to be more projective than those that described a priori less likely events ($\beta = .34$, $SE = .03$, $t = 10.6$, $p < .0001$), as revealed by a mixed effects linear regression predicting projectivity rating from fixed effects of mean prior probability (from norming study #1), mean veridicality rating (from norming study #2), and their interaction, as well as from random effects for participant, verb, clausal complement, and fact. Neither the main effect of veridicality nor its interaction with prior reached significance ($p > .26$). This was true whether the analysis was conducted on the full dataset or only on those predicates that have been claimed to be factive (colored in dark blue in Fig. 2).

- *establish, confirm* did not come out as projective, contrary to assumptions (confirm: "illusion of factivity") and previous findings (establish, variability paper)
- factive *be annoyed, know, inform, see, hear, discover* are 6 most projective predicates, but *be annoyed, inform, hear* were significantly less veridical than *know, see*

  inform, announce did not differ in veridicality (.5, lots of variability), but *inform* significantly more projective than *announce*
- *acknowledge, admit*: "illusion of factivity", but 7th and 8th most projective,

  acknowledge indistinguishable from factive *reveal, hear, discover, see*

  admit indistinguishable from factive *discover, hear, reveal*

- factive *reveal* (9th highest) indistinguishable from 'illusion" *acknowledge, admit, announce, confess, demonstrate, establish*
- 'illusion" *confess* (10th highest) indistinguishable from factive *reveal*, marginally different from *discover*
- *announce* is the lowest clearly projective predicate: mean of factH above .5 and significantly different from *think*

Theoretical implications

Presuppositions are standardly analyzed as conventionally specified conditions on the felicitous use of utterances with presupposition triggers. Such lexicalist analyses predict that presuppositions follow from utterances with presupposition triggers (modulo accommodation), regardless of whether the trigger is embedded under an entailment-canceling operator, as in (1a), or occurs in an atomic sentence, as in (1b). Consequently, lexicalist analyses of projectivity are necessarily restricted to entailed content. ABRUSAN?? An analysis of projectivity that does not rely on conventional specification, but e.g., on at-issueness is not restricted to entailed content. (e.g., **????**). Thus, the question of whether entailed and non-entailed content differs in projectivity will help decide between theories.

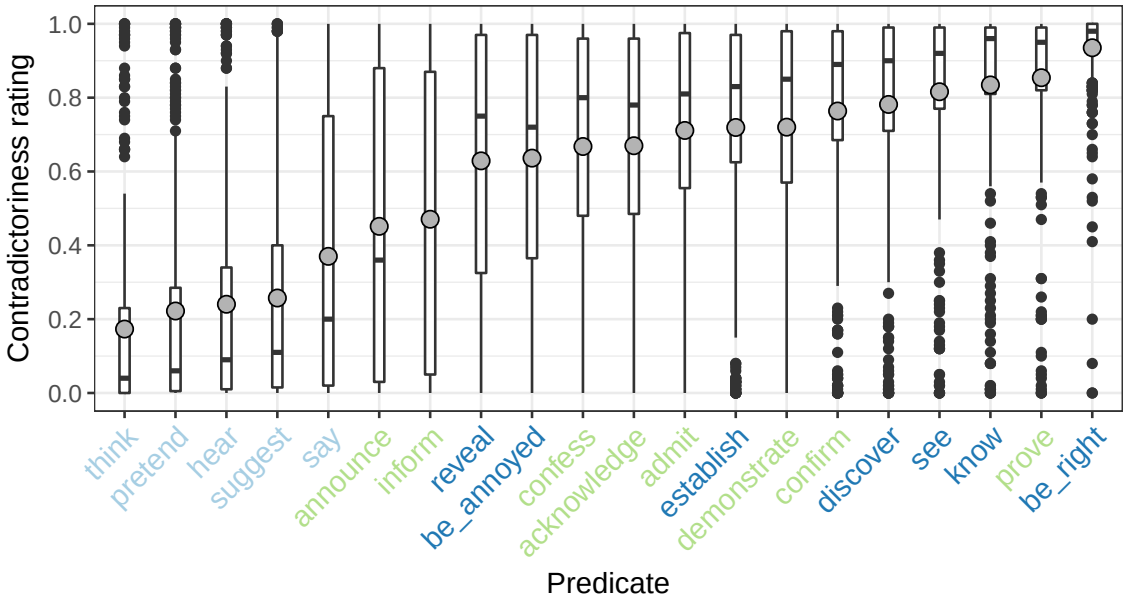

Figure 1: Boxplot of contradictoriness ratings by predicate, collapsing across complement clauses. Grey dots indicate means and notches indicate medians.

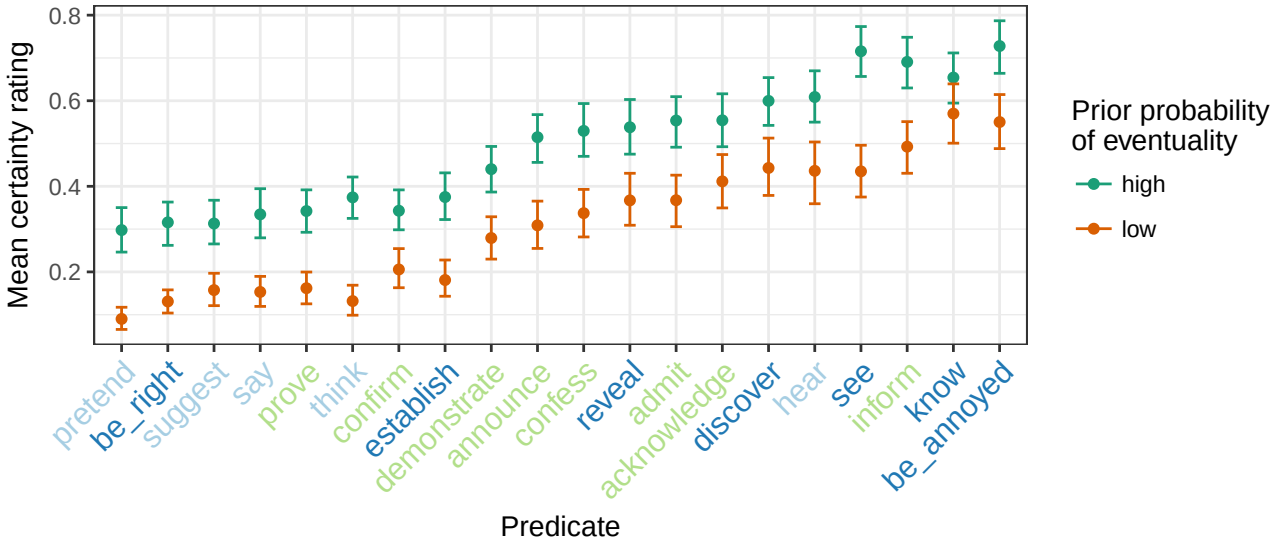

Figure 2: Mean certainty (projectivity) ratings by predicate and fact type, collapsing across complement clauses. Error bars indicate 95% confidence intervals.