Implicit Causality Biases Influence Relative Clause Attachment

In support of a comprehension model in which pragmatic biases are integrated with syntactic processing, we show that expectations about upcoming discourse continuations influence the resolution of local structural ambiguity. Specifically, in an off-line story-continuation experiment and an on-line self-paced reading experiment, we show that expectations about upcoming explanations impact relative clause (RC) attachment.

Previous work has demonstrated that pronouns in sentences containing so-called implicit causality (IC) verbs (e.g. *detest* in (1)) are preferentially interpreted to refer to a causally-implicated referent (*Bob* in (1); Caramazza et al. 1977, *inter alia*).

(1) John detests Bob because he…

Specifically, *detest* imputes causality primarily to its direct object, which, when combined with the causal connective *because*, creates an expectation that the pronoun in the ensuing explanation is more likely to refer to the object than the subject.

This property of object-biased IC verbs allows us to pose a novel question with respect to RC processing. In addition to providing information to restrict the modified noun (as in 2a), RCs can be co-opted to provide an explanation of the matrix-clause event as well (as in 2b).

(2) John detests the children $\begin{cases} \text{(a)} & \text{who live down the street}_{[\text{restriction only}]} \\ \text{(b)} & \text{who are generally arrogant and rude}_{[\text{restriction + explanation}]} \end{cases}$

Given the widely reported low-attachment bias in English, comprehenders would expect the RC in (3) to modify *the musician* rather than *the children* (Cuetos & Mitchell 1988, *inter alia*). However, in light of the aforementioned properties of IC verbs, we hypothesized that a high-attachment bias might emerge in cases in which an explanation-providing RC follows an object-biased IC verb as in (3), since the causally-implicated referent is in the high-attachment position.

(3) John $\begin{cases} \text{detests}_{\text{IC}} \\ \text{babysits}_{\text{NON-IC}} \end{cases}$ the children of the musician who $\begin{cases} \text{are}_{\text{HIGH}} \\ \text{is}_{\text{LOW}} \end{cases}$ generally arrogant and rude.

                    (a)   (b)

This reasoning only goes through, of course, if comprehenders, having processed the initial part of a matrix clause, (i) use information from the matrix IC verb to generate expectations for an upcoming explanation, (ii) are implicitly aware that an RC could provide such an explanation, (iii) know that the direct object is the causally implicated referent for the verbs in question, and (iv) use all of these when making an online *syntactic* attachment decision.

Story Continuations: Participants wrote completions for prompts like the variants in (3a). As predicted, in comparison with non-IC verbs, IC verbs yielded (i) significantly more explanation-providing RCs, and (ii) significantly more high-attaching RCs.

Reading Times: Participants read sentences as in (3a-b) in a moving-window, self-paced reading study. In each case, an IC or non-IC verb was paired with a low- or high-attaching RC (attachment level was disambiguated by number agreement on the embedded verb). We analyzed reading times on the disambiguating verb and two spillover regions. At the first spillover region (i.e. at *generally* in (3))—crucially before the reader could establish whether the RC provided an explanation of the main-clause event—we found the predicted interaction between verb type and RC attachment level. Whereas the low-attachment bias emerged for non-IC verbs, the *high-attaching* RCs following IC verbs were read *fastest* among the four conditions.

These results suggest that comprehenders construct discourse contexts dynamically during sentence processing, using available pragmatic cues mid-sentence to generate expectations about the structural analysis of the remainder of the sentence.