The interaction of syntactic focus and semantic prediction in comprehension

Eleonora J. Beier, Adrian Zhou & Fernanda Ferreira (University of California, Davis)

Introduction. Sentence structure is a powerful cue that can focus the comprehender's attention on certain information (e.g., the sentence *What John ate was a sandwich* uses a pseudo-cleft to syntactically focus on the object *sandwich*). Previous research has shown that comprehenders are more likely to notice semantic anomalies when they are syntactically focused (Bredart & Modolo, 1988), and syntactically focused words receive longer reading times (Lowder & Gordon, 2015), suggesting that focus leads to deeper processing. Sentence structure is also commonly used to signal the information structure of a sentence, with given information receiving less focus and new information more focus. It has been hypothesized that comprehenders make stronger semantic predictions of upcoming words when they expect new information (Ferreira & Lowder, 2016). To test this, we conducted a visual world paradigm study to assess the individual contributions of focusing and de-focusing syntactic constructions in English, as compared to a "neutral" baseline, on the effects of semantic prediction.

Method. In each trial, participants listened to a short story with three parts: an introductory sentence, a context sentence that sets up an expectation through a context word, and a target sentence that contains a predictable target word that matches the expectation. The structure of the target sentence was manipulated to create three focus conditions: focused, neutral, and defocused (see Table 1 for example stimulus). Stimuli were normed in a cloze test to ensure that the target word was always the most predictable object based on the context word. For each story. the length of the interval between the context word and target word was equated across focus conditions. While participants listened to the short story through headphones, their eye-movements were recorded as they viewed an array of four images that included the predictable target object, an unpredictable but plausible distractor, a context-related distractor, and an unrelated distractor (see Figure 1 for example). To examine how the focus conditions affect participants' tendency to look at each type of object over time, we fitted a generalized additive mixed model with a binomial response variable (number of fixation samples inside the object's interest area vs. those outside) as our dependent variable, focus condition as our independent variable, and participant and item as random effects.

Results. For the predictable target object, compared to the neutral condition, there were significantly fewer fixations when the target sentence was syntactically focused (β = -0.04, SE = 0.01, p < .001) and defocused (β = -0.09, SE = 0.01, p < .001). For the plausible distractor, there were fewer fixations to this object only when the target sentence was syntactically defocused (β = -0.07, SE = 0.01, p < .001). The plausible distractor seemed to attract more fixations in the focused condition, but that difference was only marginally significant (β = 0.02, SE = 0.01, p = 0.06). For both context distractor and unrelated distractor, there were no significant differences between conditions overall. (See Figure 2 for plotted model estimates)

Discussion. When information was syntactically focused, it changed the content of prediction (participants made less looks to the target object and more looks to the plausible alternative). When information was syntactically defocused, it reduced the strength of prediction (less looks to both target object and plausible alternative). These results suggest that syntactic focus influences semantic predictions as they unfold, with different effects associated with focusing and defocusing constructions.
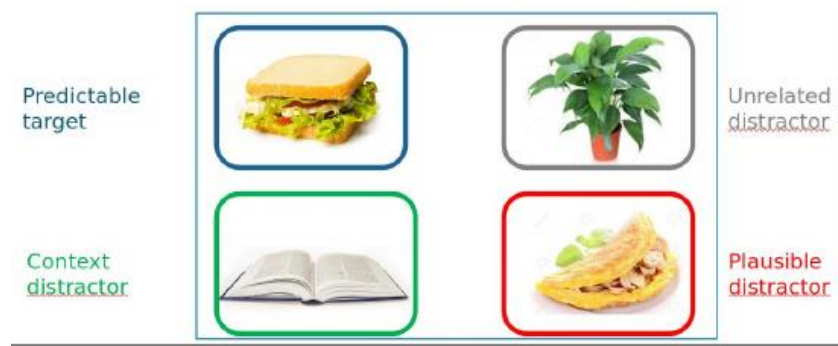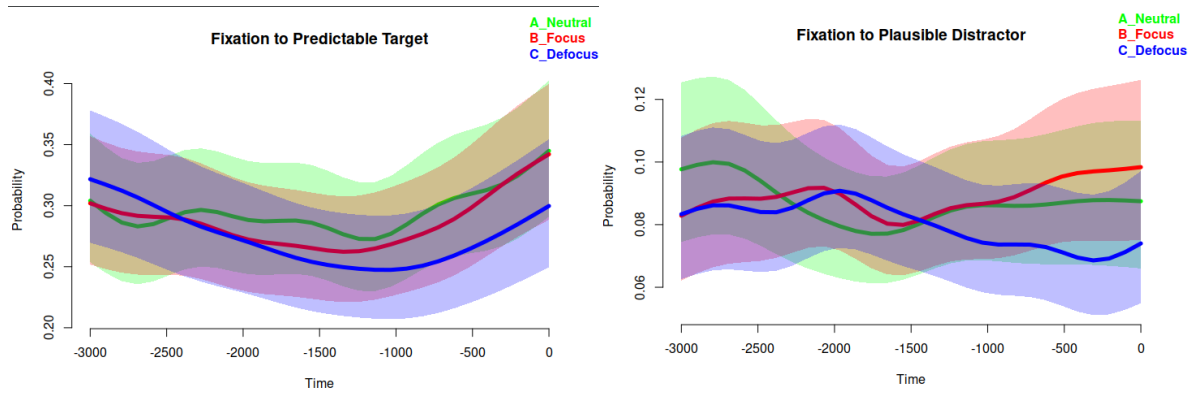
Figure 1. Example visual stimulus

Figure 2. GAMM Estimates for Predictable Target and Plausible Distractor. Time 0 is onset of target word

Table 1

Example Stimulus

Introductory Sentence	John was trying to concentrate on his homework, but kept getting distracted.
Context Sentence	He realized it was probably because he was hungry, so he made himself some **lunch**.
Focused target sentence	What he made was a tasty **sandwich**, ...
Neutral target sentence	He made a tasty **sandwich**, ...
De-focused target sentence	After he made a tasty **sandwich**, ...

References

Bredart, S., & Modolo, K. (1988). Acta Psychologica, 67(2), 135-144.

Lowder, M. W., & Gordon, P. C. (2015). Psychonomic bulletin & review, 22(6), 1733-1738.

Ferreira, F., & Lowder, M. W. (2016). Prediction, information structure, and good-enough language processing. In Psychology of learning and motivation (Vol. 65, pp. 217-247). Academic Press.