The Adaptation of Lexical Predictions to Speaker Reliability

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Background: Do listeners “dial down” their predictive processing when faced with an unpredictable speaker? In other words, does our predictive processing weaken when our lexical predictions are frequently disconfirmed by the speaker? Existing results on this question have been mixed (adaptation: Brothers et al., 2017, 2019, Roettger & Rimland, 2020; no adaptation: Zhang et al., 2019, von Wonderen & Nieuwland, 2023). However, with the exception of Roettger & Rimland (2020), these studies manipulated the predictability of the stimuli either between participants or between blocks. Such designs cannot tell apart two possible accounts of adaptation. One possibility is that listeners may adapt their predictive processing according to the speaker, where they may dial down predictions for speakers that they consider unreliable (the "speaker” account). Alternatively, listeners may simply statistically adapt to the predictability of recent linguistic input, without attributing it to the speaker (the “stimuli” account). Lastly, prediction may be an automatic process that does not adapt to either the speaker or the stimuli (the null hypothesis). To tease apart these possibilities, we interleaved utterances by predictable and unpredictable speakers in the present experiment and asked whether listeners adapt their predictive processing according to the reliability of the speakers.

Experiment: We conducted a visual world eye-tracking experiment in Mandarin Chinese (n=22) with one within-subject variable of speaker predictability. We used 80 highly constraining sentential frames (e.g. “John is an astronomy fan and bought himself a ___.”) with two possible endings – the expected noun (“telescope”, mean cloze probability = 63.6%) and an unexpected but still plausible noun (“computer”, mean cloze probability = 2.4%). One male and one female Chinese speaker recorded these sentences. Each participant heard 40 utterances with the expected ending by a reliable speaker interleaved with 40 utterances with an unexpected ending by an unreliable speaker, where the gender of the speakers was counterbalanced. In each trial, they were presented with four pictures including the expected target, the unexpected target, and two unrelated distractors (Figure 1).

Results: Figure 2 shows the time course of looks to the four pictures displayed in each speaker condition. We measured listeners’ anticipatory looks by analysing their fixation proportion on the expected object in the 500ms window before the target noun onset. Overall, listeners showed anticipatory looks to the expected picture in this time window ($p<0.001$), with no difference between the two Speaker conditions ($p>0.1$). The fixation proportion did not decrease over the course of the experiment (Figure 3). We logit-transformed the fixation proportion and conducted a linear mixed-effects regression (fixProp ~ Speaker*Trial + (Speaker|Subject). We found no significant main effects of Speaker, Trial, and no Speaker*Trial interaction (all *p*s>0.1). Predictive looks did not decrease over the experiment in either Speaker condition (*p*s>0.1).

Discussion: Our experiment shows that lexical predictions, as indicated by anticipatory eye-movements, persist throughout the experiment for both the reliable and the unreliable speakers. These results point to two possibilities. The first possibility is that predictive processing is an automatic process insensitive to speaker or stimuli reliability (van Wonderen & Nieuwland, 2023). The second possibility is that the adaptation of predictive processing depends on (1) the strength of the prediction violation and (2) the specific kind of predictive cues used (e.g. syntactic vs semantic vs prosodic). For (1), the unexpected targets in our experiment were still plausible, so the listeners may simply accept them without adjusting their processing strategy. Future experiments could make the unexpected target semantically anomalous and observe if such a strong violation drives adaptation. And as for (2), we are currently running an experiment with the same design but instead manipulating the reliability of specific classifiers as syntactic predictors of upcoming nouns in Chinese. The unreliable speaker produces classifiers incompatible with the following noun, a grammatical error that strongly violates predictions.

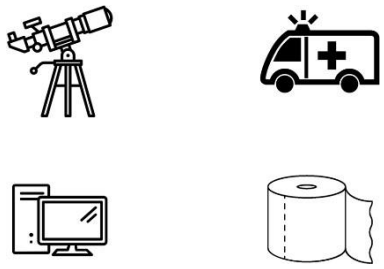

Figure 1. A sample visual display

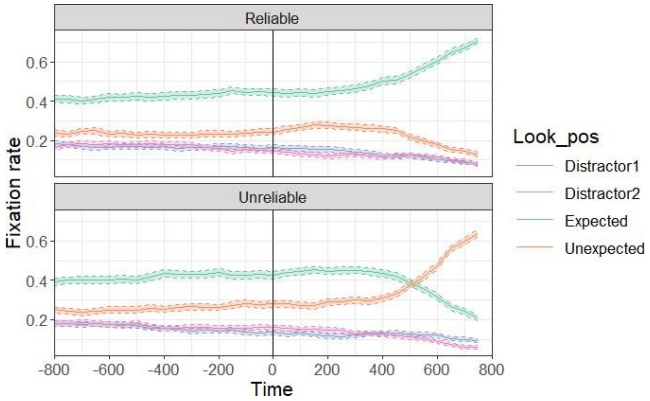

Figure 2. Time course of looks to each picture relative to the target onset, in each speaker condition

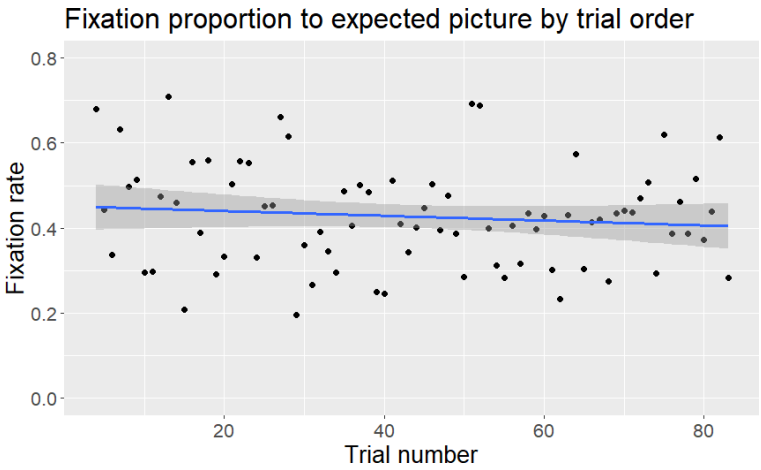

Figure 3. Fixation proportion to the expected picture in the 500ms pre-target window by trial order

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