Listeners' beliefs about the speaker and adaptation to the deviant use of prosody

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A growing number of studies report that listeners process prosodic cues rapidly enough to predict an upcoming referent, prior to encountering disambiguating lexical material [1,2]. In addition, language processing changes in response to language input, known as *linguistic adaptation* [3,4]. Adaptation studies manipulating prosody suggest that speakers down-weight prosodic cues when the cues are not reliable [5,6]. Listeners also appear to modulate the degree to which they use boundary tone information according to how informative the cue is in the experiment [7]. One remaining question concerns whether and how listeners make use of deviant or improper prosodic marking, and if they do, whether the degree of adaptation is modulated by listeners' belief about the speaker's intention. On the one hand, listeners might simply put less weight on prosody in syntactic analysis with improper prosodic marking. On the other, listeners might learn speaker-specific prosodic patterns to make anticipatory judgments about the intended meaning. In order to address these possibilities, the current study compared how listeners responded to proper uses of contrastive accent (L+H*) on an adjective-noun pair (1a; *red cat* followed by *PURPLE cat*) in Experiment 1 to improper uses of contrastive accent (2a; *red cat* followed by *PURPLE pig*) in Experiments 2 and 3, which further differed in whether listeners knew the speaker's intention.

Experiments. Eye movements from native speakers of English were recorded in a visual-world eye-tracking paradigm. Experiment 1 (N=36) tested whether proper use of contrastive accent (1a) leads to anticipatory looks to a target object as compared to a condition that did not have contrastive accent. Experiment 2 (N=35) tested how listeners respond to sentences that have improper use of contrastive accent (2a). Using exactly the same materials as in Experiment 2, participants in Experiment 3 (N=33) were informed before the experiment that the speaker was not trustworthy. This allowed us to explore how listeners might learn to adapt to speaker-specific uses of contrastive prosody in an array of communicative settings.

Results. We used LMER models to analyze the proportion of looks made to the target object (*purple cat* in Exp. 1, *purple pig* in Exp. 2 and 3). To determine if the listeners made anticipatory eye movements before the onset of the target object, we analyzed the time window from the onset of color adjective (*purple*) until the minimum onset of final noun (*cat/pig*, anticipatory time window). We included Prosody (with or without contrastive accent) and Trial Order (1 to 90) and their interaction as factors in the model. In **Exp.1 (target: *purple cat*)**, participants looked more at the target object with contrastive accent than without it (p <0.05, Fig. 2). Crucially, the effect was observed before participants heard the disambiguating word, indicating that participants used contrastive accent to anticipate the upcoming word that was most likely to contrast with the previous word, given the visual array. In **Exp.2 (target: *purple pig*)**, no effect of prosody was observed in the anticipatory time window, suggesting that improper use of contrastive accent interfered with the use of prosodic information to make anticipatory eye movements. A combined analysis between Experiment 1 and 2 showed a main effect of Experiment ($p<0.05$), confirming that on hearing the adjective information, participants in Experiment 2 looked less at the object that made a contrast with the previous object compared to participants in Experiment 1. In **Exp.3 (target: *purple pig*)**, an interaction between Prosody and Trial Order was observed in the anticipatory time window ($p<0.05$, Fig. 3, 4), demonstrating that listeners learned how to predict the upcoming referent with improper contrastive accent over the course of the experiment. A combined analysis between Experiment 2 and 3 showed a marginal three-way interaction of Prosody × TrialOrder × Experiment ($p=0.057$), suggesting that learning effect of improper use of contrastive accent was significant only in Experiment 3.

Conclusion. We found that listeners used contrastive accent to anticipate upcoming information, and that they did not use prosody when the use of contrastive accent was unconventional. However, when listeners learned that the speaker was uncooperative, they adapted to the speaker's specific mapping between prosody and meaning, allowing them to anticipate an upcoming referent on the basis of improper, but consistent, contrastive accent. The results suggest that listeners' beliefs about the speaker's intention modulate the extent to which a listener is willing to adapt her expectations during prosodic processing.

Materials

Experiment 1

(1) First, find the red cat.
a. *Proper* contrastive accent: Next, find the PURPLE$_{L+H*}$ cat.
b. Control sentence: Next, find the purple cat.

Experiment 2 and 3

(2) First, find the red cat.
a. *Improper* contrastive accent: Next, find the PURPLE$_{L+H*}$ pig.
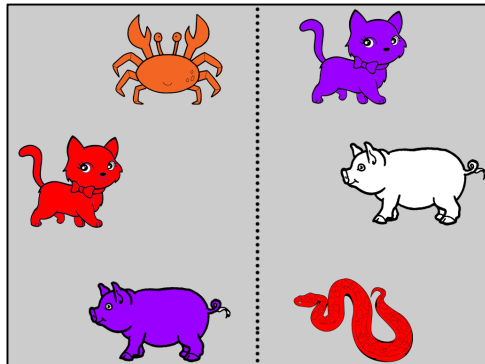b. Control sentence: Next, find the purple pig.

Fig. 1 Visual array in experiments

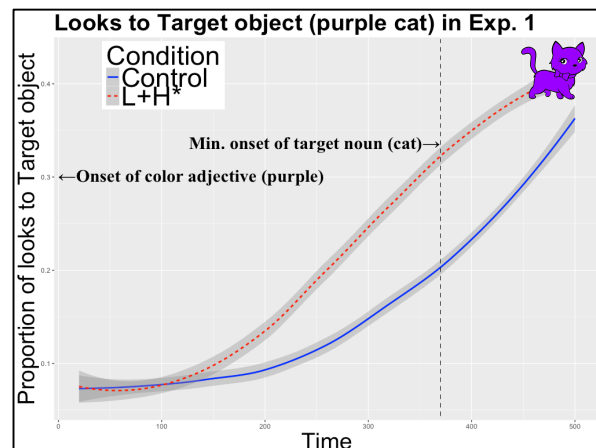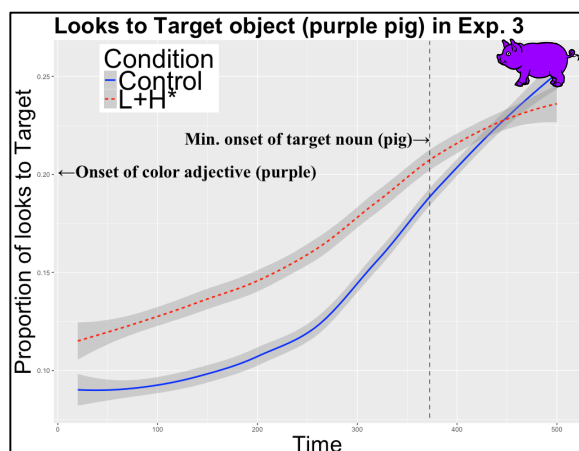
Fig. 2 Looks to the target object in Exp. 1
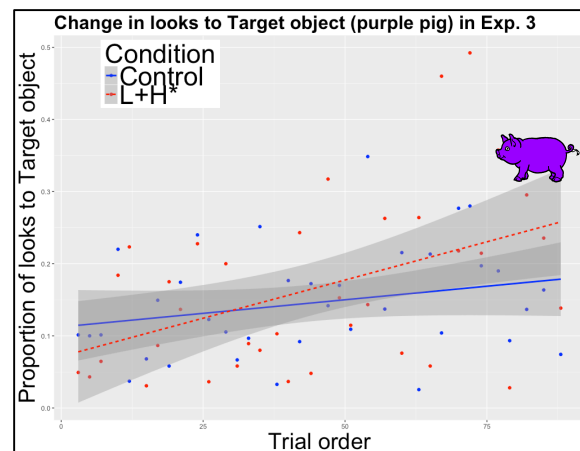

Fig. 3 Looks to the target object in Exp. 3

Fig. 4 Change in looks to the target object in Exp. 3

References

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