

Updating predictions in the presence of a local competitor: A visual-world study

Kayla Keyue Chen, Jingyi Gao, Wing-Yee Chow
University College London

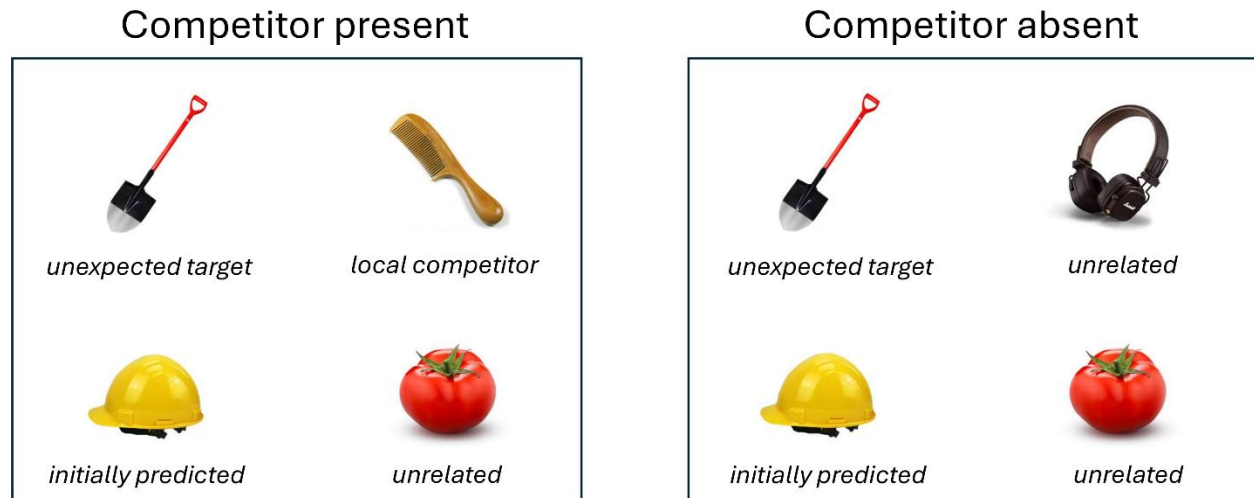
Comprehenders use contextual information to predict upcoming words [1] and dynamically revise their predictions when encountering information that is inconsistent with their initial predictions [2]. Successful language comprehension requires balancing top-down representations with bottom-up input. Prior research suggests that irrelevant representations may be activated through the spread of activation from bottom-up cues, even when these representations conflict with the global context [3-4]. When prediction updating is triggered by an informative cue, irrelevant representations can also be activated, potentially delaying or hindering successful updating. Here we examined whether a luring competitor, compatible with local information (a nominal classifier) but incompatible with the broader context, delays or interferes with prediction updating in a visual world eye-tracking experiment. Our findings indicate that comprehenders were drawn to the local competitor upon encountering the informative cue, impacting the efficiency of prediction updating. Nevertheless, the effect of global context was substantially greater than that of local context, and the interference effect from the luring competitor was small.

Methods. Native Mandarin Chinese speakers ($n = 63$) listened to sentences while viewing a display of four objects (see Fig. 1). The sentence context, such as (1), strongly predicted a specific noun like “*helmet*”, but always concluded with an unexpected yet plausible noun like “*shovel*”. The critical manipulation involved the presence/absence of a competitor, such as “*comb*”, that was implausible within the global context but shared the same specific classifier as the target noun “*shovel*”. In the competitor-absent condition, the competitor (“*comb*”) was replaced by an unrelated object (“*headphones*”, which was the competitor in another item) which did not share the same specific classifier as the target noun. Meanwhile, the pronominal classifier in the sentence was manipulated to be either specific or general. Specific classifiers served to trigger prediction updating as they were incompatible with the initial prediction (“*helmet*”) but compatible with both the target and competitor (“*shovel*” and “*comb*”); general classifiers served as an uninformative control as they were compatible with all of the nouns depicted on the screen.

(1) (originally in Chinese) When workers enter the construction site to work, they must bring one {CL_{ba} (specific) / CL_{ge} (general)} high-quality shovel.

Results. We used linear mixed-effects models on the log odds of fixation proportions for the three critical objects across several time windows, with time shifted by 200 ms to account for saccade planning (see Fig. 2). In the pre-classifier window, listeners were more likely to fixate on the initially predicted object than the other three objects, indicating predictions based on the global sentential context. In the classifier window, listeners were more likely to fixate on the unexpected target upon hearing a specific classifier than a general classifier, replicating the rapid prediction updating effect [2]. The influence of the local competitor became significant in the adjective and noun windows: the likelihood of fixating on the unexpected target upon hearing the specific classifier was lower when the local competitor was present on the screen than when it was absent. Correspondingly, the local competitor attracted more fixations than the unrelated control object.

Conclusion. We investigated whether prediction updating in response to an informative cue remains effective when a luring competitor is simultaneously present. Our findings indicate that, although prediction updating occurs successfully, the competitor is activated and attracts fixations when it is compatible with a local cue. This suggests that prediction updating benefits from the automatic, bottom-up spread of activation from local information while remaining strongly constrained by the global context.



工人们进入建筑工地干活，一定要带上一把^(specific)/些^(general)质量好的铁锹。
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Fig 1. Sample sentence materials and visual display. In the competitor-present condition, the distractor object was a local competitor (*comb*) which shared the same specific classifier as the unexpected target (*shovel*), whereas in the competitor-absent condition, the distractor object was unrelated (*headphones*).

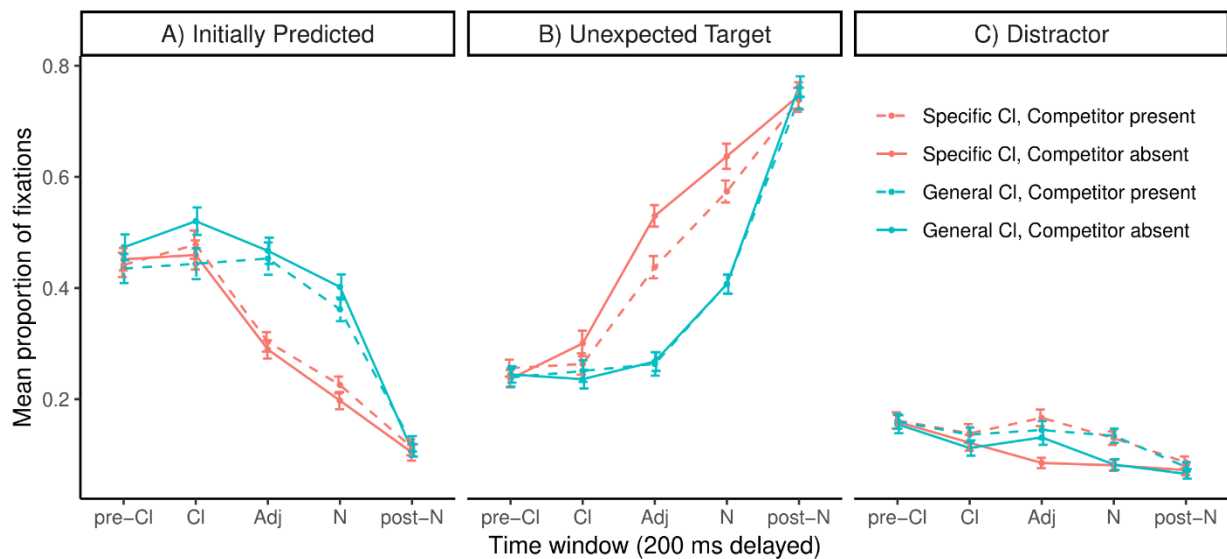


Fig 2. Mean fixation proportions and standard errors for the (A) initially predicted object (*helmet*), (B) unexpected target (*shovel*), and (C) the distractor (*comb/headphones*) across five time-windows and four conditions. The boundaries of the time windows were shifted by 200 ms to account for saccade planning.

Reference

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