

Comprehenders use consecutive cues to update prediction incrementally: Evidence from eye-tracking and ERPs

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Comprehenders can predict upcoming language based on global context [1-2] and use disconfirming evidence or informative cues to update their predictions rapidly [3-4]. While some studies suggest that prediction violations could incur additional processing cost [5-6], it remains unclear how they may affect subsequent processing. This study investigated comprehenders' ability to use consecutive cues to update predictions for an upcoming noun. We found that processing a cue that conflicts with an existing prediction does not incur measurable cost on subsequent semantic processing, such that listeners can use consecutive cues to incrementally update their prediction very efficiently.

We utilised the noun phrase structure in Mandarin Chinese (e.g., one CL_{zhang} chess-playing table) where the classifier and modifier could be informative about an upcoming noun. We constructed sentence contexts that were strongly predictive of a particular noun (expected, e.g., "tree" in Fig. 1) but always ended with a relatively unexpected noun (target, e.g., "table"). We manipulated both the type of classifiers (specific vs. general) and modifiers (informative vs. uninformative). The specific classifier (CL_{zhang}) was compatible with the target but not with the expected noun, whereas the general classifier (CL_{xie}) was compatible with both the target and expected noun. Meanwhile, the informative modifier ("chess-playing") fitted the target but was incompatible with the expected noun, whereas the uninformative modifier ("good-looking") was compatible with both nouns. We asked whether a classifier that signalled a prediction error could influence the use of a subsequent modifier for updating predictions by looking at potential interactions between the two factors.

In Exp 1 (visual-world eye-tracking), participants (n=50) listened to the sentences while viewing four pictures displayed on the screen (Fig. 1). We used GAMM to look at the proportion of fixations to the target object from 200 ms after classifier onset to 200 ms after noun onset. Significant main effects of classifier and modifier and a lack of interaction between the two showed that listeners looked more to the target object upon hearing an informative modifier compared to an uninformative modifier, no matter whether it follows a specific or a general classifier (Fig. 2). In Exp 2 (EEG), participants (n=38) read sentences word by word at a fixated rate. Linear mixed effects model of the target noun's N400 amplitude revealed a significant main effect of classifier and modifier but no interaction. Across both classifier types, the N400 response to the target noun was reduced when it was preceded by an informative modifier compared to an uninformative modifier (Fig. 3).

These findings showed that an early sign of prediction error (i.e., a specific classifier) did not incur measurable costs affecting subsequent semantic processing (i.e., the use of an informative modifier). Comprehenders can use consecutive cues to update predictions.

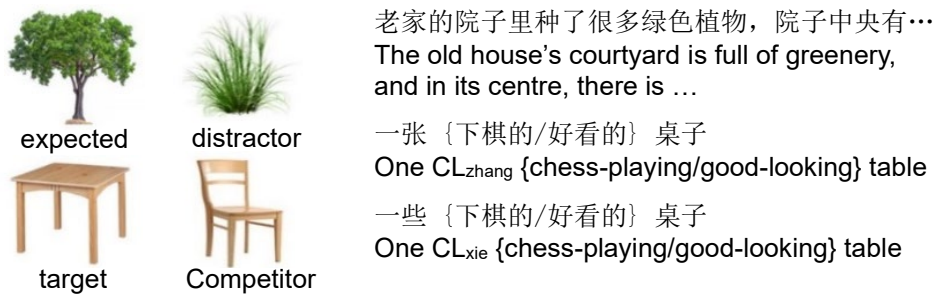


Figure 1. Sample material and visual display.

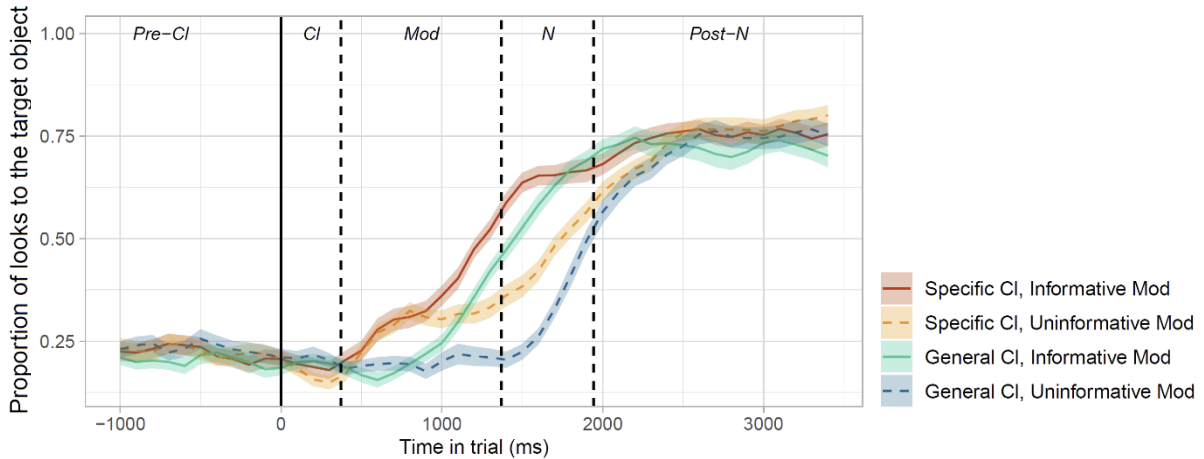


Figure 2 (Exp 1, visual-world eye-tracking). Proportions of looks to unexpected target object, time-locked to the classifier onset (0 ms), across four conditions. Standard errors were shown in semi-transparent shades.

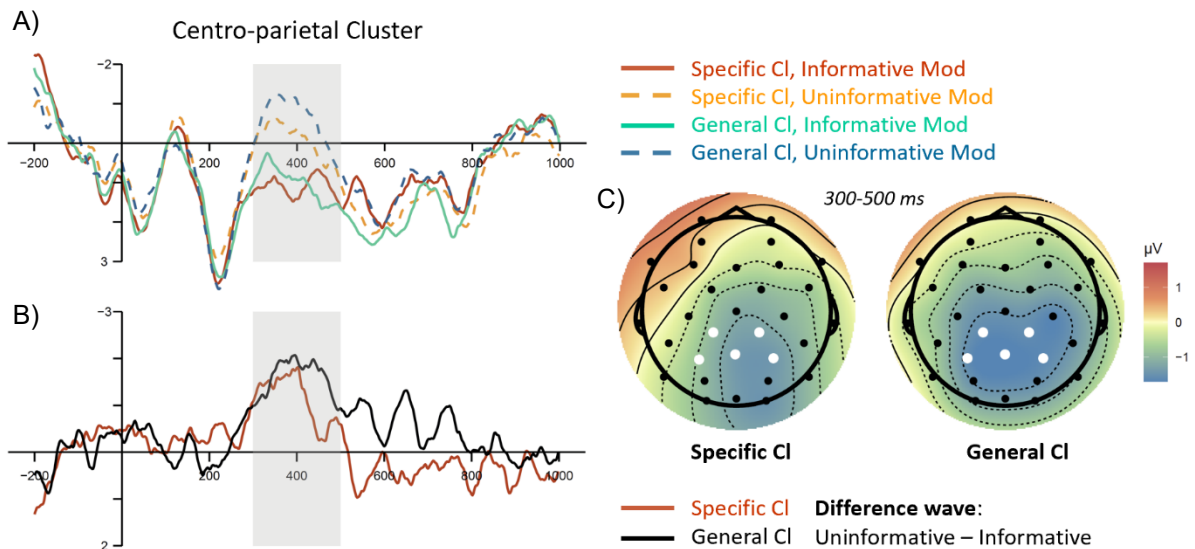


Figure 3 (Exp 2, EEG). A) Average ERPs in four conditions in the centro-parietal cluster [7]. B) Difference between informative and uninformative modifier conditions within each classifier condition. C) The topographic distribution of the effects of modifier on the target noun in the 300-500 ms time window in each classifier condition. Electrodes in the centro-parietal cluster were highlighted.

Reference

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