

Unexpected information triggers rapid prediction updating: Evidence from eye movements

Kayla Keyue Chen, Ingrid M. Johansen, Wing-Yee Chow

Division of Psychology and Language Sciences, University College London
keyue.chen.19@ucl.ac.uk



INTRODUCTION

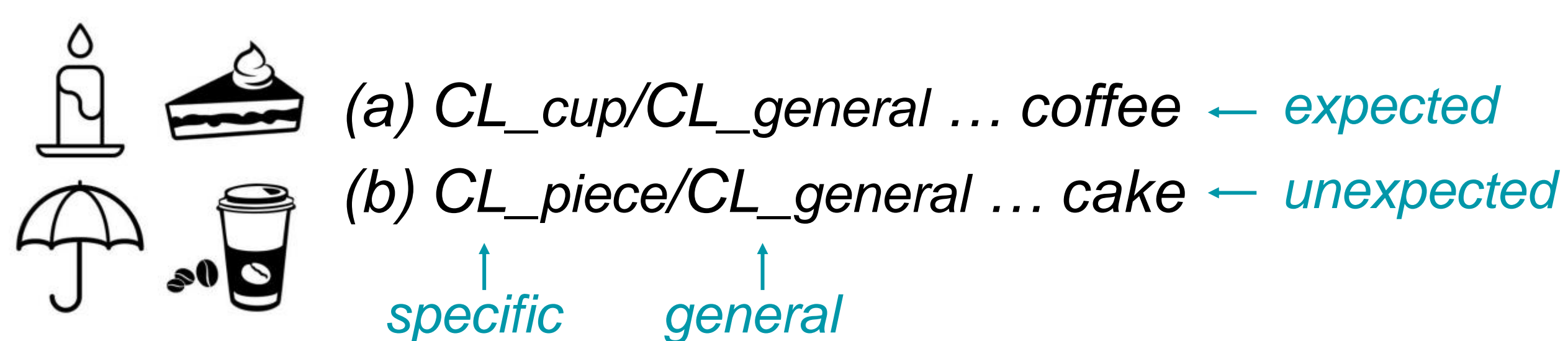
Comprehenders can use rich contextual information to predict upcoming language in real time [1-3].

- They can also use unexpected information to update their predictions very quickly [4, 5].

Updating predictions based on unexpected cues

A recent study [5] examined listeners' sensitivity to cues that are inconsistent with their initial predictions using Chinese classifier.

Anna at Starbucks bought one



Mandarin Chinese listeners were able to rapidly redirect their eye gaze from the expected object (*coffee*) towards a previously unexpected object (*cake*) upon hearing a prediction-inconsistent nominal classifier (*CL_piece*).

→ How generalisable is the effect? Can listeners use cues that are not grammatically obligatory in their language?

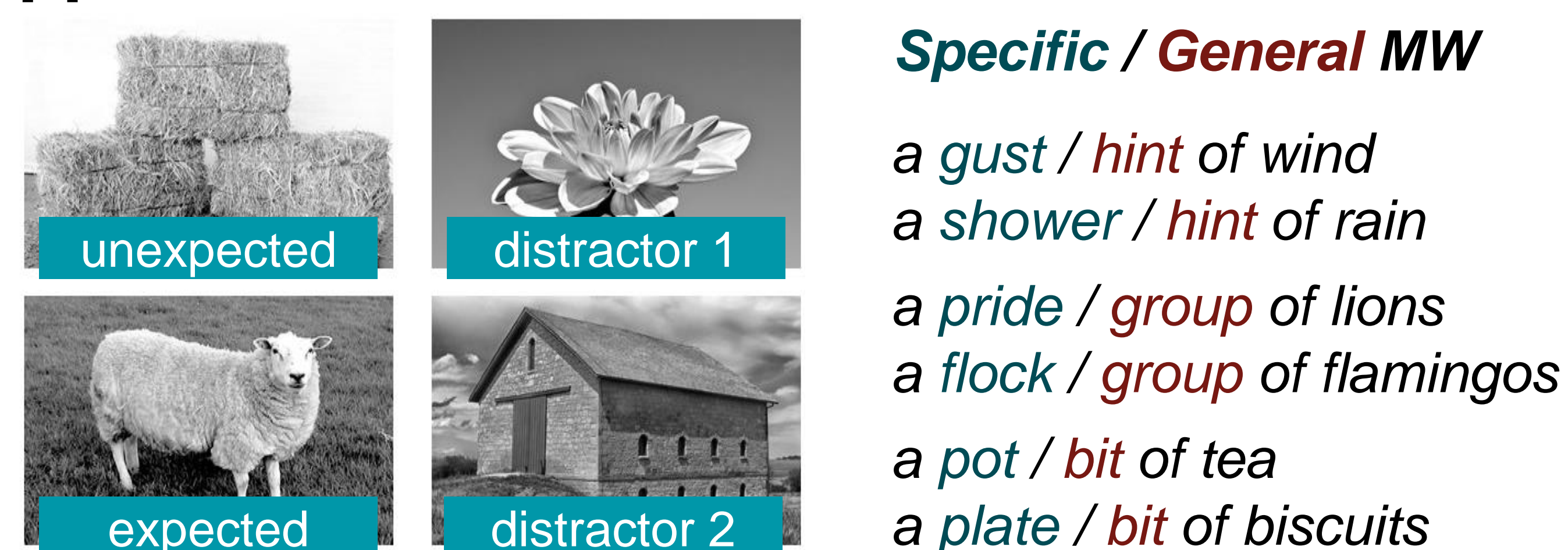
THE PRESENT STUDY

In the present study, we extended these findings to English using measure words (MW), which are not obligatory for nouns in English. We also reanalysed the data in [5] and compared the English and Chinese groups.

METHOD

A 2 × 2 design: predictability of noun (expected vs. unexpected) × MW type (specific vs. general).

Specific MWs delimit objects with certain features, whereas general MWs are compatible with a much wider range of objects [6].



(1) In the barn at the back of the field, the shepherd was keeping a

- (a) *herd / roomful of recently stolen sheep* ← expected
(b) *pile / roomful of recently stolen hay* ← unexpected

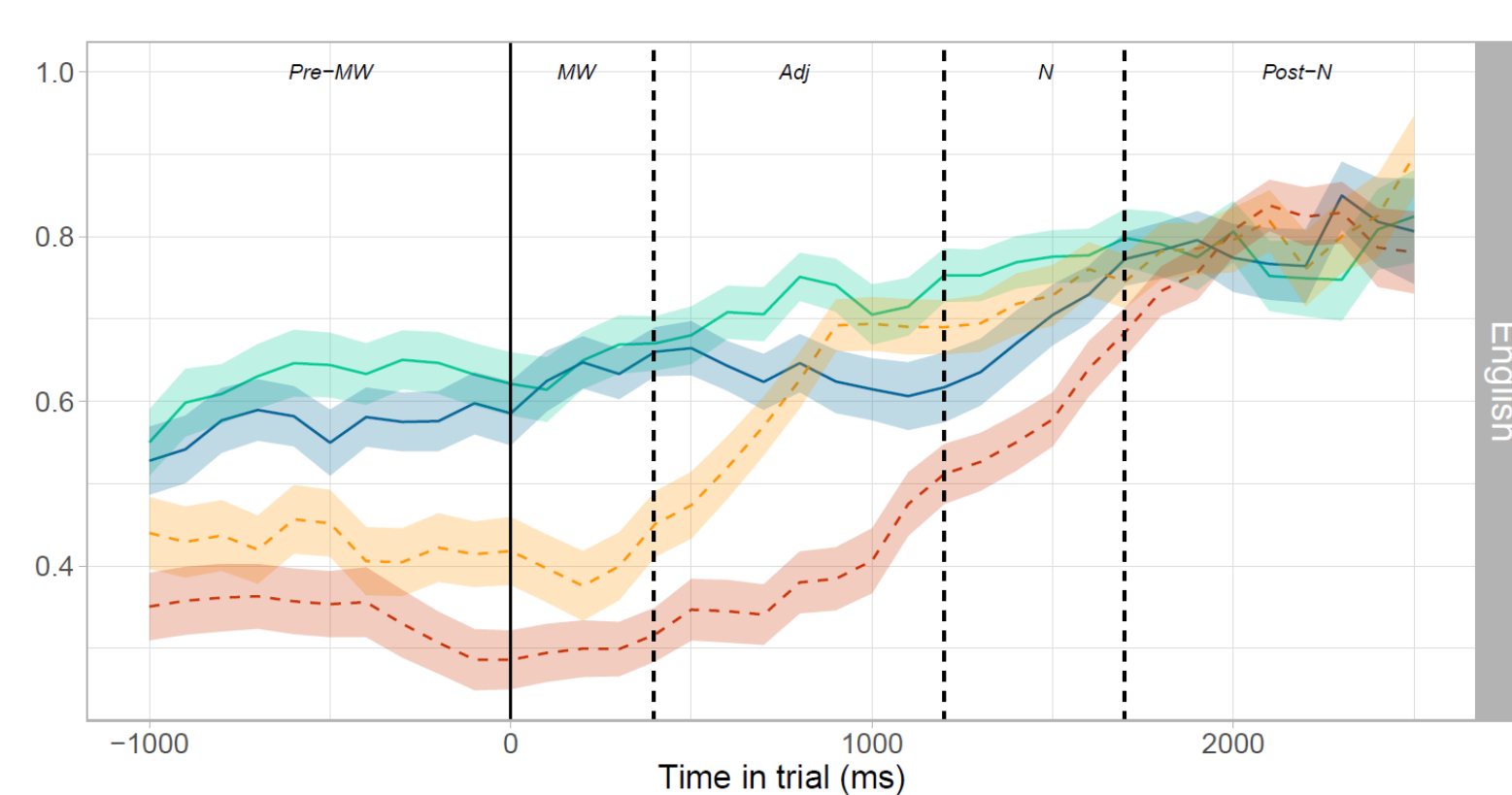
Average Cloze probability	Expected		Unexpected	
	Specific	General	Specific	General
	79%	53%	51%	5%

Participants (n=60) were presented with pictures of four objects on the screen in each trial, and we tracked their eye movements as they listened to sentences like (1). There were 24 experimental items and 56 fillers in total.

ANALYSIS

- (1) Mixed-effects logistic regressions in each time window (e.g., MW, post-MV adjective window).
- (2) Bootstrapping analyses [7] to identify the time point at which the proportion of looks to the target diverged. Compared differences in divergence points in English and the previous Chinese data [5].

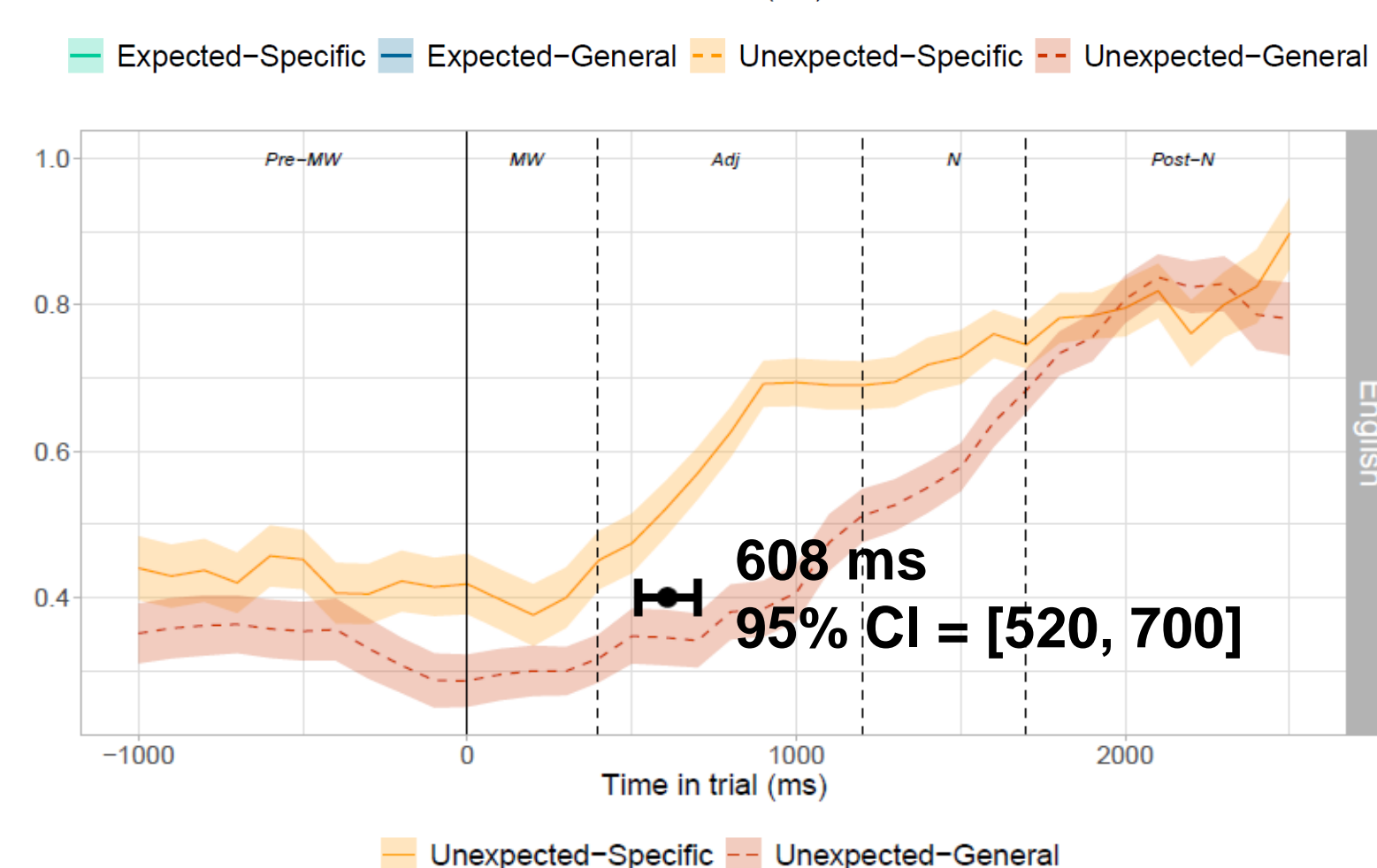
RESULTS



Prior to MW offset

Listeners were more likely to look at the expected object than the unexpected object.

→ Evidence for listeners' initial predictions

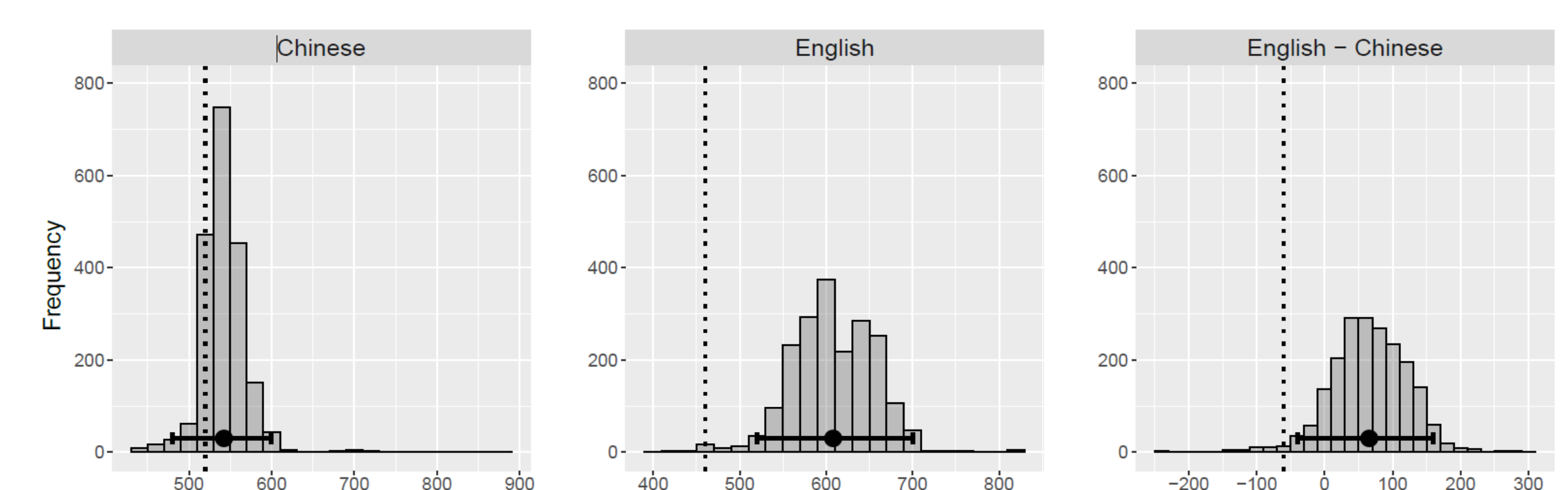
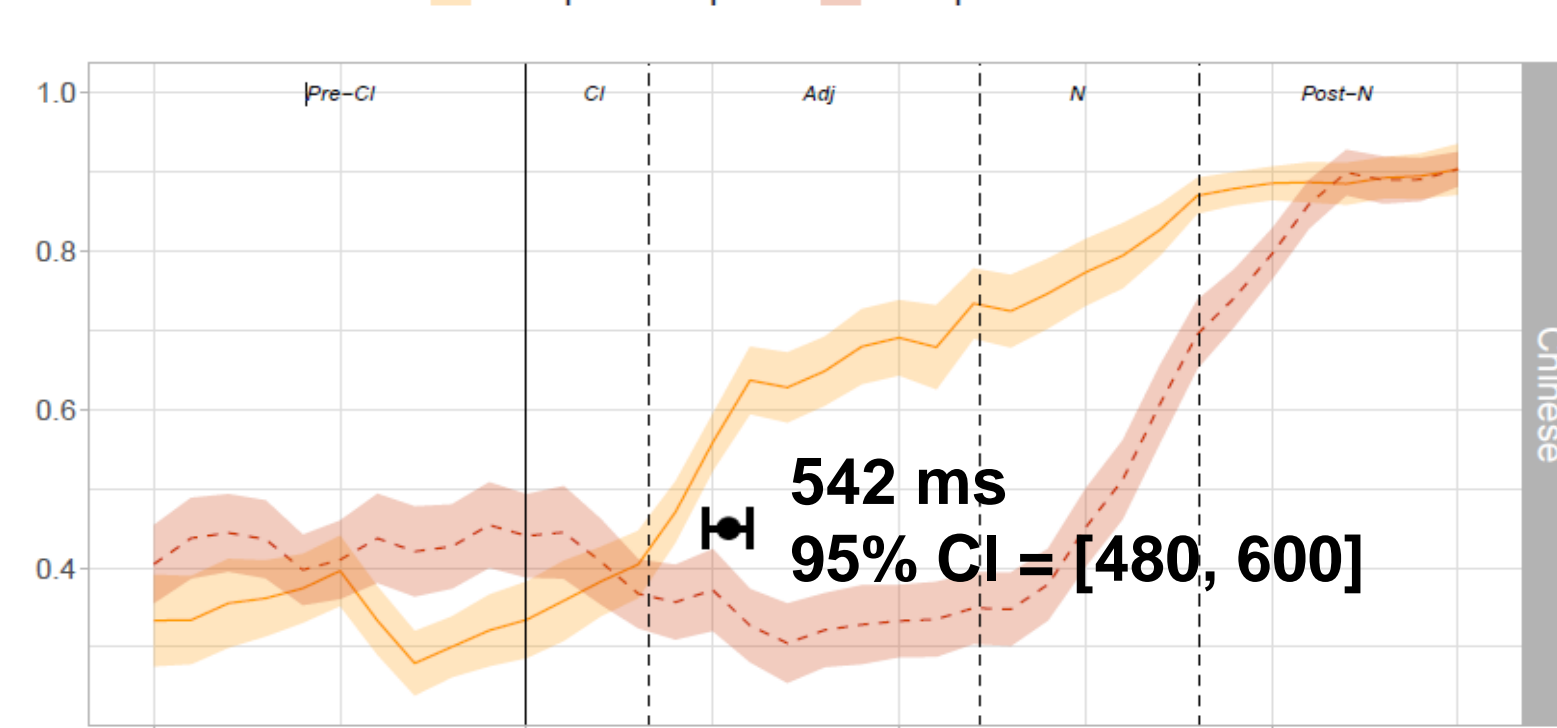


After hearing an unexpected specific MW

Listeners rapidly directed their gazes away from the expected object and toward the unexpected target.

Noun onset was on average 1199 ms after MW onset, so English listeners were able to revise their predictions upon encountering a prediction-inconsistent MW before they heard the noun.

→ Evidence for rapid prediction updating



The difference between groups was not significant when compared to a bootstrapped null distribution by randomly shuffling the group labels.

→ No significant difference between groups

CONCLUSION

Results are consistent with the effect first reported in Mandarin Chinese [5], providing further evidence that comprehenders can rapidly update their predictions in response to unexpected incoming information.

REFERENCES

- [1] Kamide, 2008. *Language and Linguistics Compass*. [2] Kutas et al., 2011. *Predictions in the brain: Using our past to generate a future* [3] Pickering & Gambi, 2018. *Psychological Bulletin*. [4] Szewczyk & Wodniecka, 2020. *Journal of Experimental Psychology: Learning, Memory, and Cognition*. [5] Chow & Chen, 2020. *Language, Cognition and Neuroscience*. [6] Klein et al., 2012. *Oxford Studies in Theoretical Linguistics*. [7] Stone et al., 2021. *Bilingualism: Language and Cognition*.