

# Covert Activation of Lexical tones in Mandarin-English Bilinguals: evidence from MEG

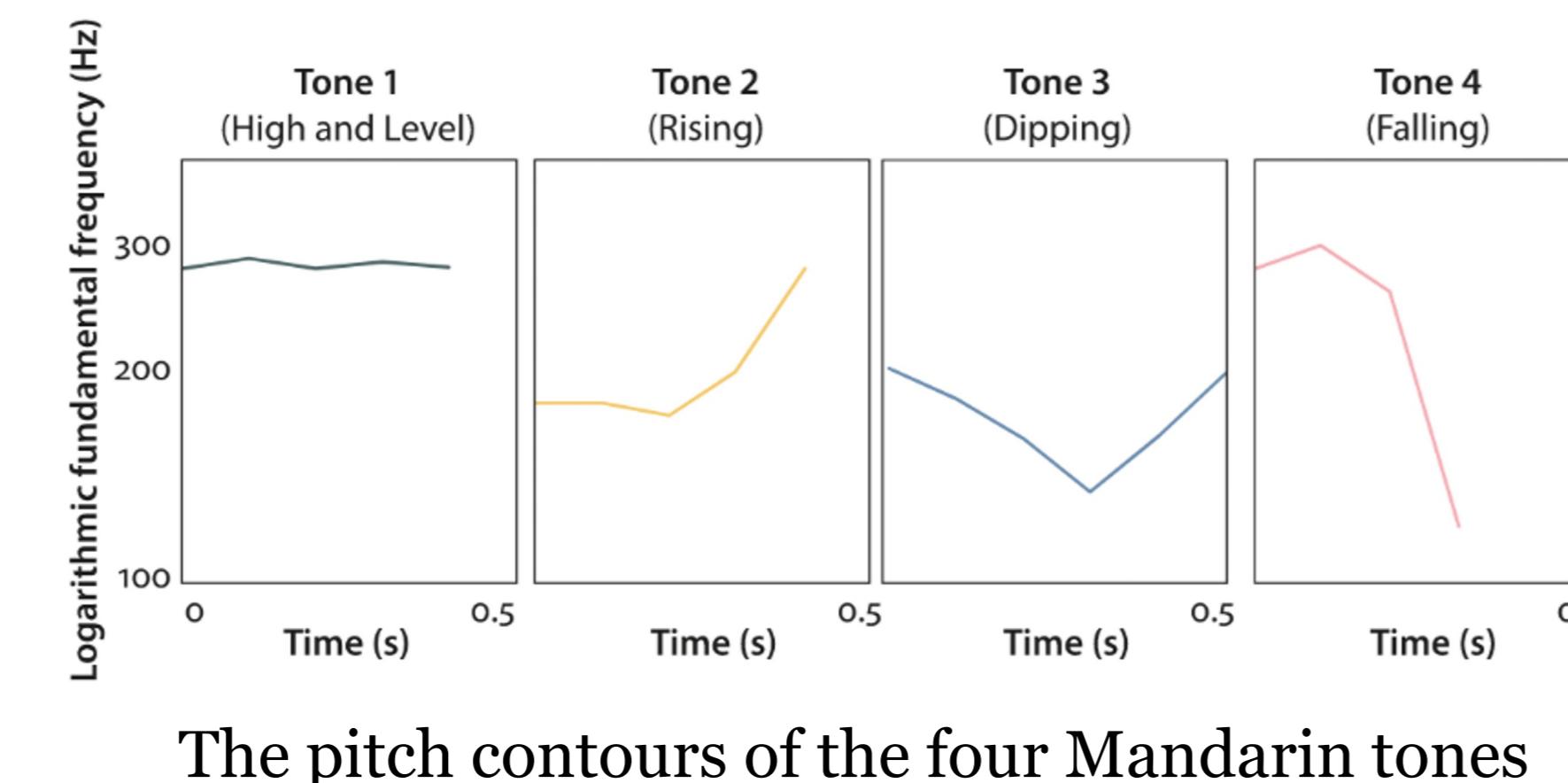
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## Introduction

- Lexical tone is a crucial cue constraining spoken word recognition in tonal languages (Malins et al., 2012; Ye & Connine, 1999).
- Wang et al. (2017) demonstrated that Mandarin-English bilinguals covertly activated Mandarin representations at both segmental and tonal levels in an English-only task without any cross-language phonological overlap in the auditory input.



## Research Aim

- We replicated Wang et al. (2017) and investigated the neural basis of covert activation of lexical tones in Mandarin-English bilinguals with Magnetoencephalography (MEG).

## Method (Picture-Word Matching Task)

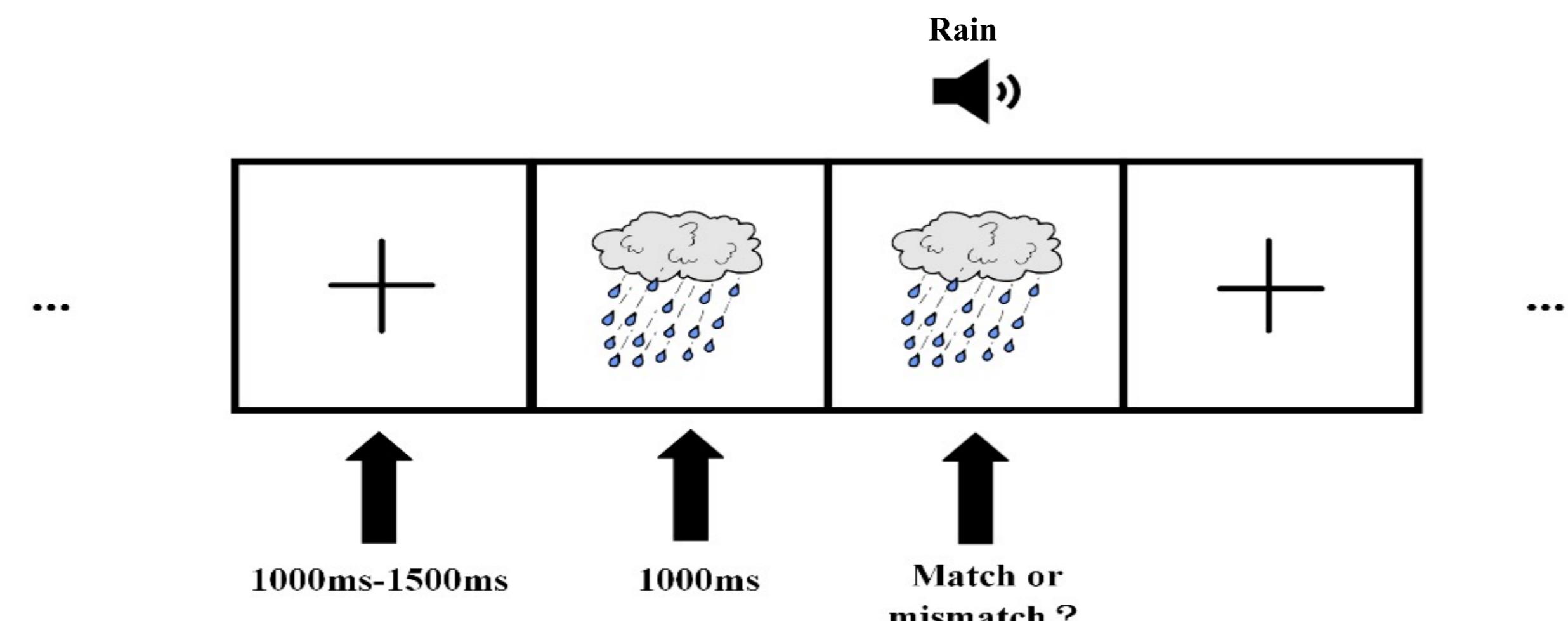
- Participants:** 25 Mandarin-English bilinguals ( $M_{age} = 25$ )

- Stimuli:**

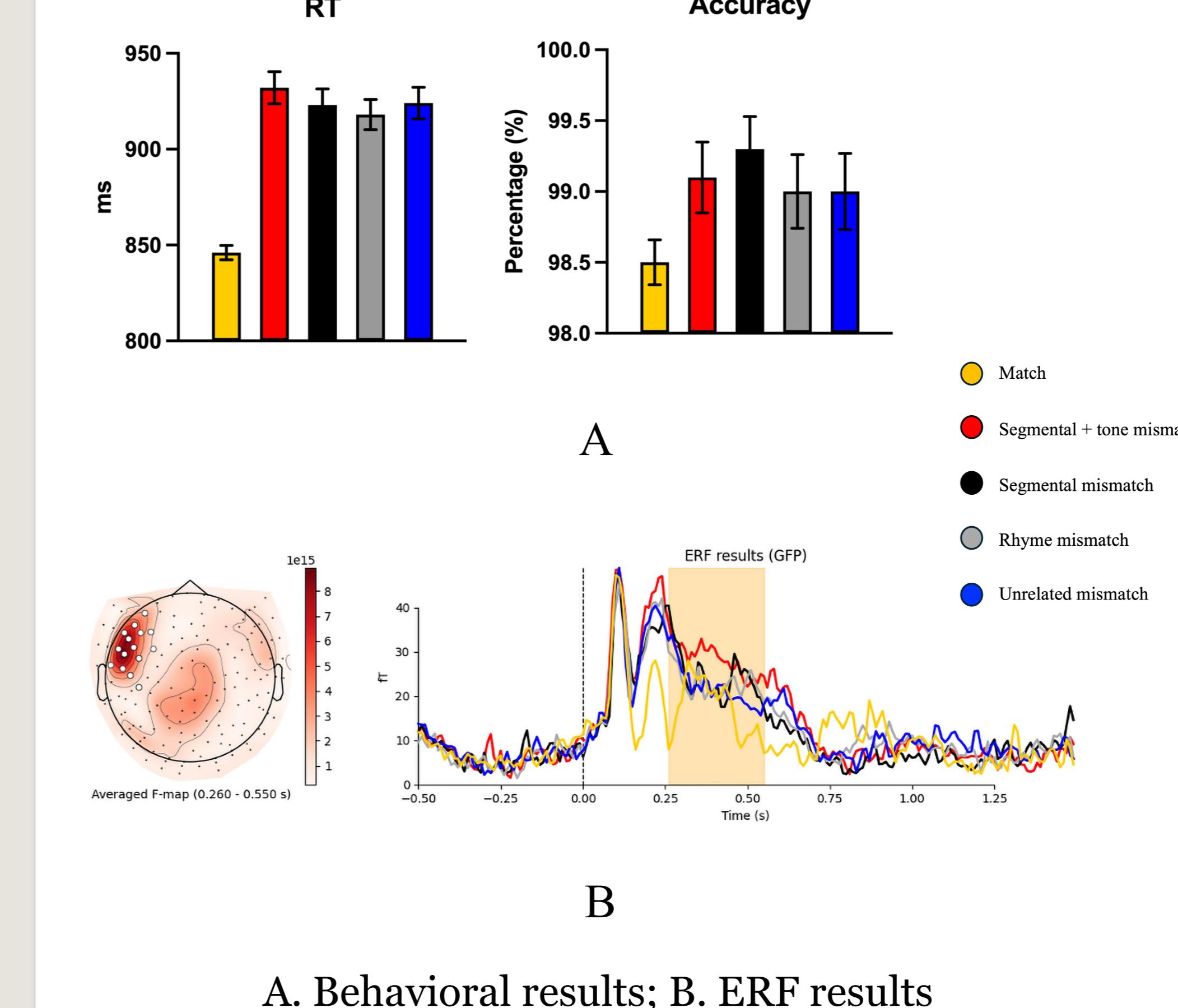
Picture	Segmental + Tone Mismatch	Segmental mismatch	Rhyme + Tone mismatch	Unrelated mismatch	Match	
Auditory target (English/Mandarin)	rain/yu3	feather/yu3	fish/yu2	wheat/gu3	bear/xiong2	rain/yu3

Note: The numbers indicate the tones of the Mandarin words.

- Procedure:**



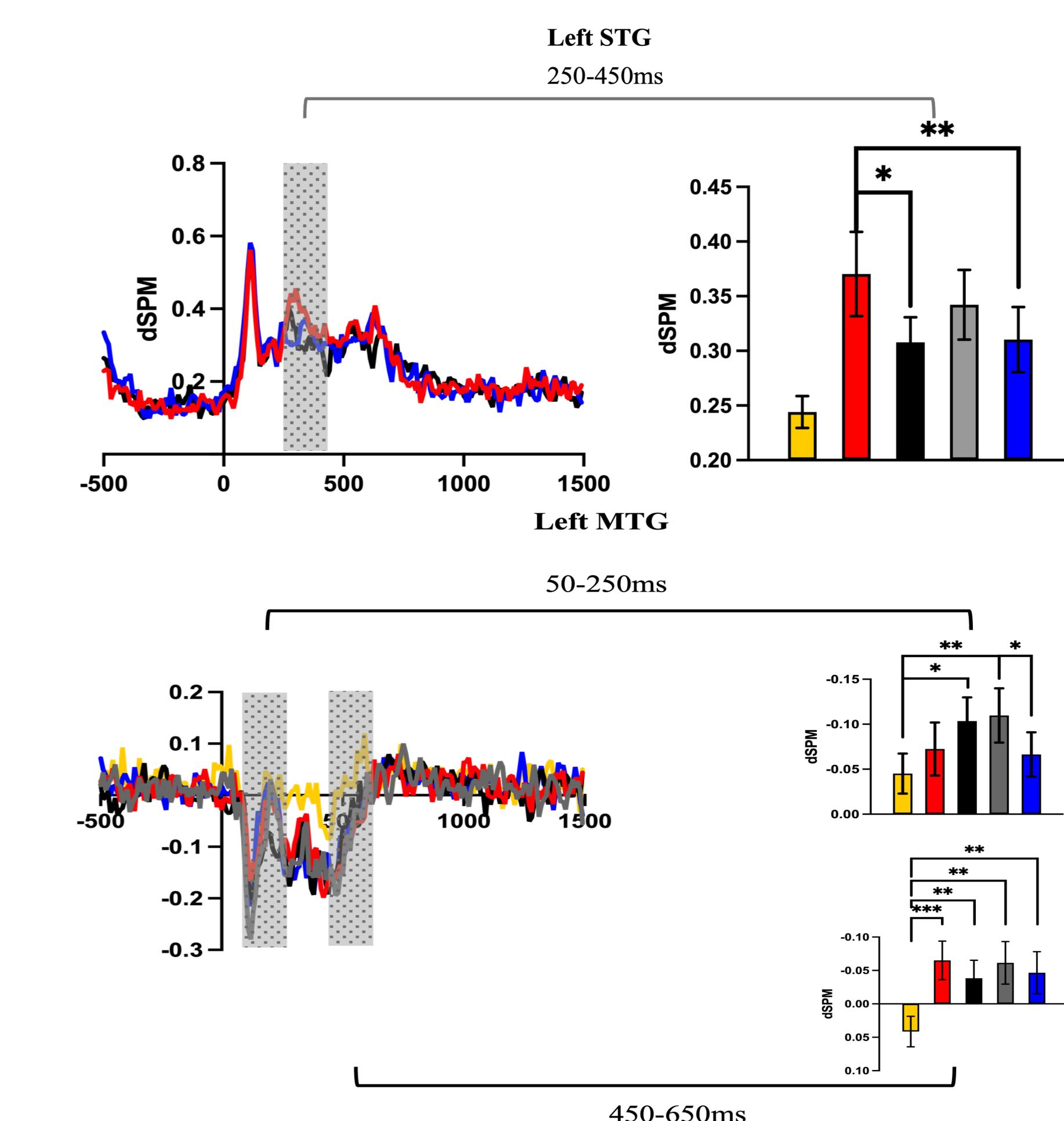
## Behavioral & ERF Results



A. Behavioral results; B. ERF results

- Reaction times were significantly longer in the four mismatch conditions than the match condition (all  $p < 0.001$ ). No difference across conditions in accuracy.
- The ERF results revealed a significant main effect of Response Type ( $p = 0.023$ ). The clusters distributed around the left-frontal region during the 260-550ms time window.

## ROI Results



- In the mismatch conditions, the **segmental + tone condition** elicited significant larger brain activities compared to the **segmental condition** ( $p = 0.004$ ) and the **unrelated condition** ( $p = 0.03$ ) in the left STG during the 250 – 450ms time window. No other difference was observed across the other mismatch conditions.
- In the left MTG, besides the difference between the match condition and mismatch conditions ( $p < 0.05$ ), the rhyme mismatch gave rise to a larger brain waveform than the unrelated mismatch condition ( $p = 0.028$ ).

## Conclusions and Implications

- Only the **segmental + tone condition** induced cross-language activation during the 250-450ms time window in the left STG.
- Bilingual listeners implicitly accessed L1 lexical tones (and segments) when performing an L2 task, even without any cross-language phonological overlap in the auditory input.
- The current study provides neural evidence that lexical tones are obligatory in eliciting cross-language activation through the top-down/lateral pathway (e.g., automatic translation).

**References** [1] Malins, J. G., & Joanisse, M. F. (2012). Setting the tone: An ERP investigation of the influences of phonological similarity on spoken word recognition in Mandarin Chinese. *Neuropsychologia*, 50(8), 2032-2043. [2] Wang, X., Wang, J., & Malins, J. G. (2017). Do you hear ‘feather’ when listening to ‘rain’? Lexical tone activation during unconscious translation: Evidence from Mandarin-English bilinguals. *Cognition*, 169, 15–24. [3] Ye, Y., & Connine, C. M. (1999). Processing spoken Chinese: The role of tone information. *Language and Cognitive Processes*, 14(5–6), 609–630.

**Acknowledgements** Thanks to the Centre for Language Sciences, Department of Linguistics and MEG lab, School of Psychological Science at Macquarie University, China Scholarship Council and National Imaging Facility for support.



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