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

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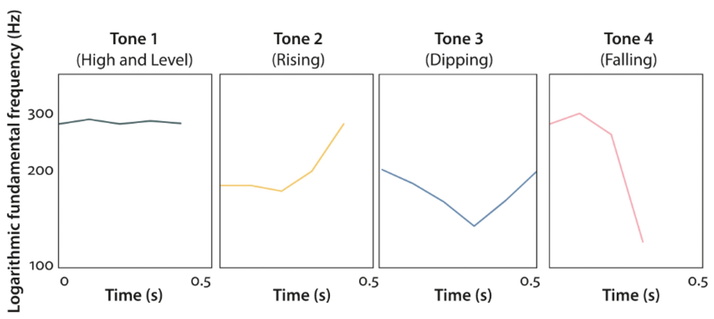
Introduction

- 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.



The pitch contours of the four Mandarin tones

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).

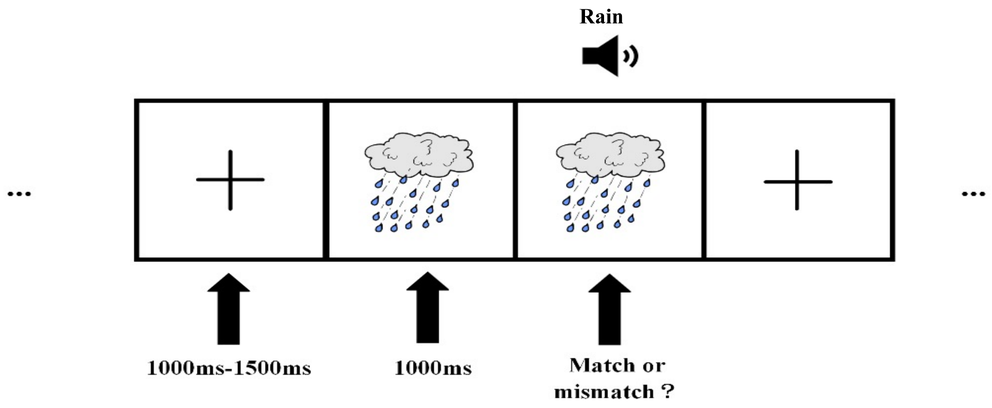
Method (Picture-Word Matching Task)

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

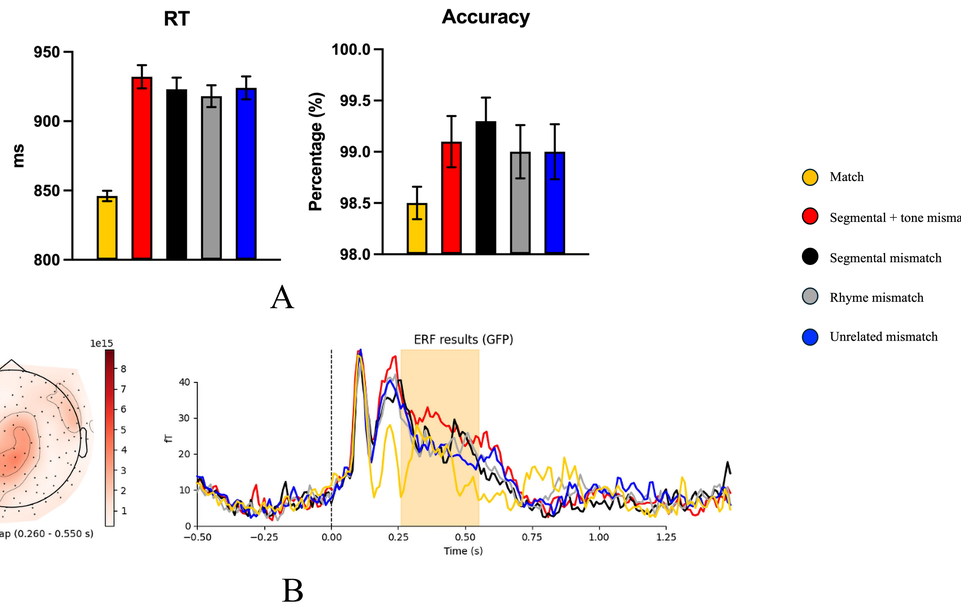
Auditory target (English/Mandarin) \ Picture	Segmental + Tone Mismatch	Segmental mismatch	Rhyme + Tone mismatch	Unrelated mismatch	Match
rain/yu3	feather/yu3	fish/yu2	wheat/gu3	bear/xiong2	rain/yu3

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

- **Procedure:**



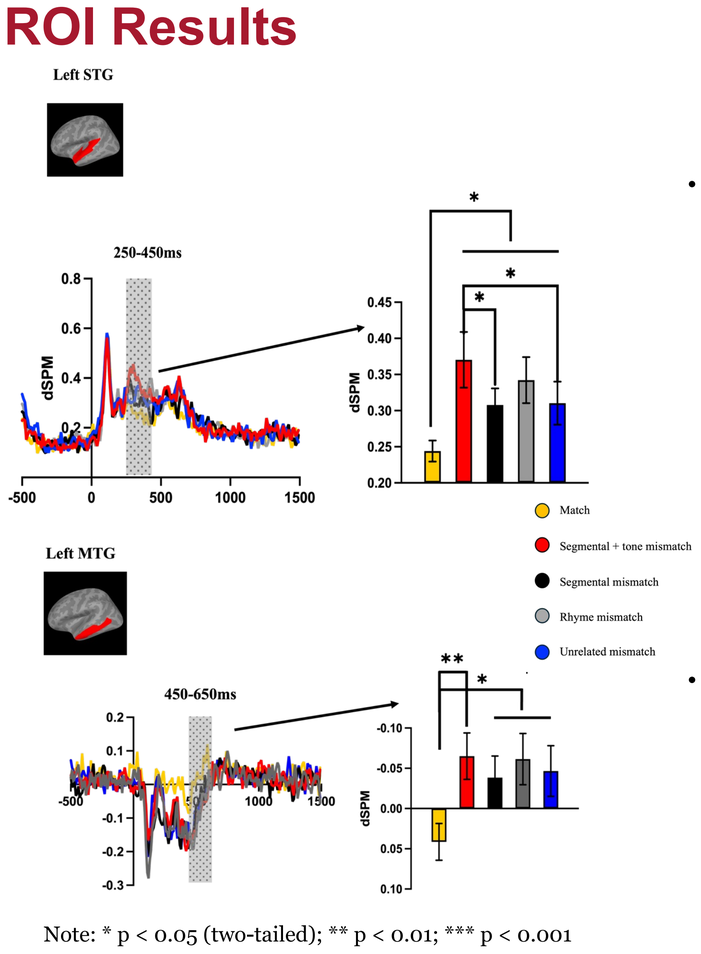
Behavioral & ERF Results



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



Note: * p < 0.05 (two-tailed); ** p < 0.01; *** p < 0.001

- 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, the significant differences between the match condition and mismatch conditions were observed (all $p<0.05$).

Conclusions and Implications

- Only the **segmental + tone condition** induced cross-language activation during the 250-450ms time window in the left STG.
- Both the left STG and the left MTG were involved in auditory lexical processing.
- 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).
- Our findings highlight the critical role of the left STG in cross-language phonological activation involving lexical tones.

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.

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