Mandarin third-tone sandhi is incompletely neutralizing in perception as well as production: Evidence from visual world eye-tracking

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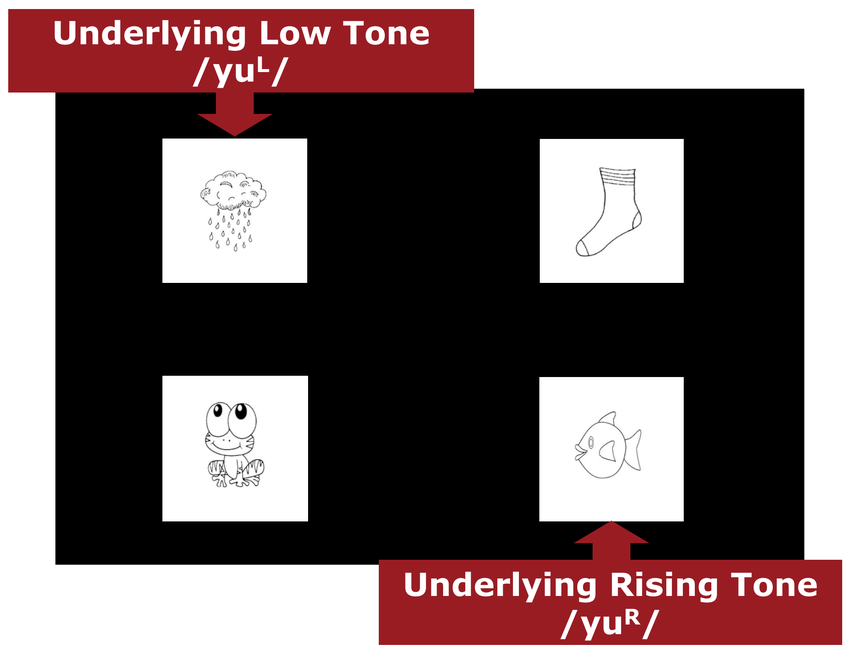
Background

- Third Tone Sandhi is a phonological alternation in Mandarin Chinese whereby a syllable that is underlying Low tone (Tone 3) is pronounced with a Rising tone (Tone 2) in certain contexts
  - e.g., 保 *bao*^{L} -> *bao*$^{[R]}$ in the compound 保险 *bao*$^{/L/}$*xian*^{L}
- Third Tone Sandhi is **incompletely** neutralizing in **production**…
  - The Derived Rising tone is lower than Underlying Rising tone (Peng, 1996, 2000; Zhang & Lai, 2010)
- …but **completely** neutralizing in **perception**
  - Listeners cannot hear the difference between the Derived and Underlying Rising tones (Peng, 1996, 2000; Zhang & Lai, 2010)
- Perception results are based on explicit metalinguistic judgments

BUT…. Listeners may be sensitive to the difference between Derived and Underlying Rising tones at the unconscious, automatic level, just not for metalinguistic judgments

Design

Visual World Eye-tracking



- Auditory stimuli (Latin-squared):

Condition	Chinese					Translation
Derived Rise	请 qing	将 jiang	雨 **yu**$^{/L/}$	点 **dian**^{L}	出来 chulai	"Click on **rain**"
Underlying Rise	请 qing	将 jiang	鱼 **yu**$^{/R/}$	点 **dian**^{L}	出来 chulai	"Click on **fish**"

Pilot results (*n*=6)

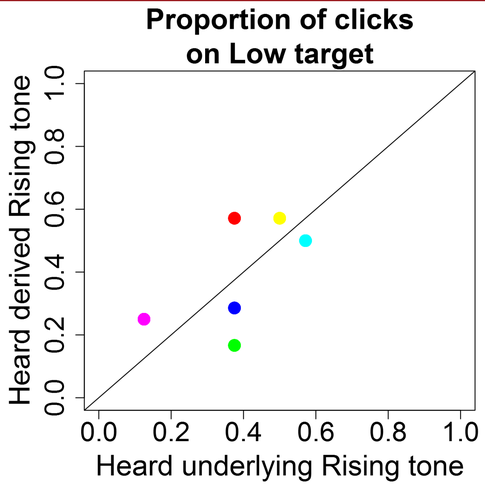


***Figure 1*:** Behavioural results. The diagonal line indicates zero difference between conditions

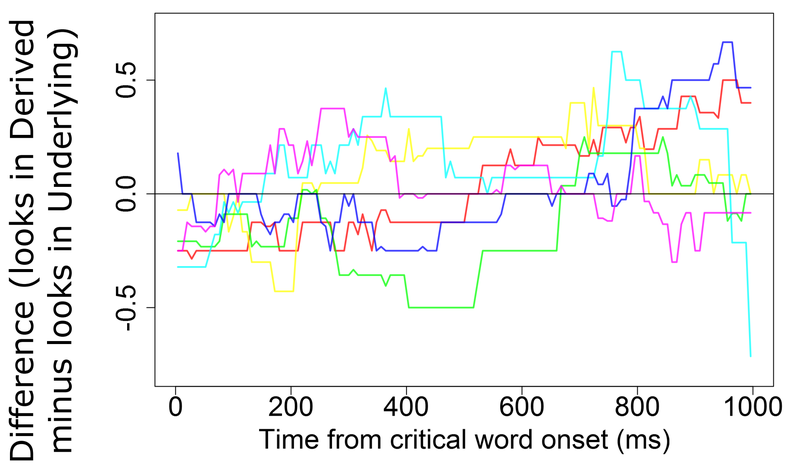


***Figure 3*:** Eye-tracking individual participant results

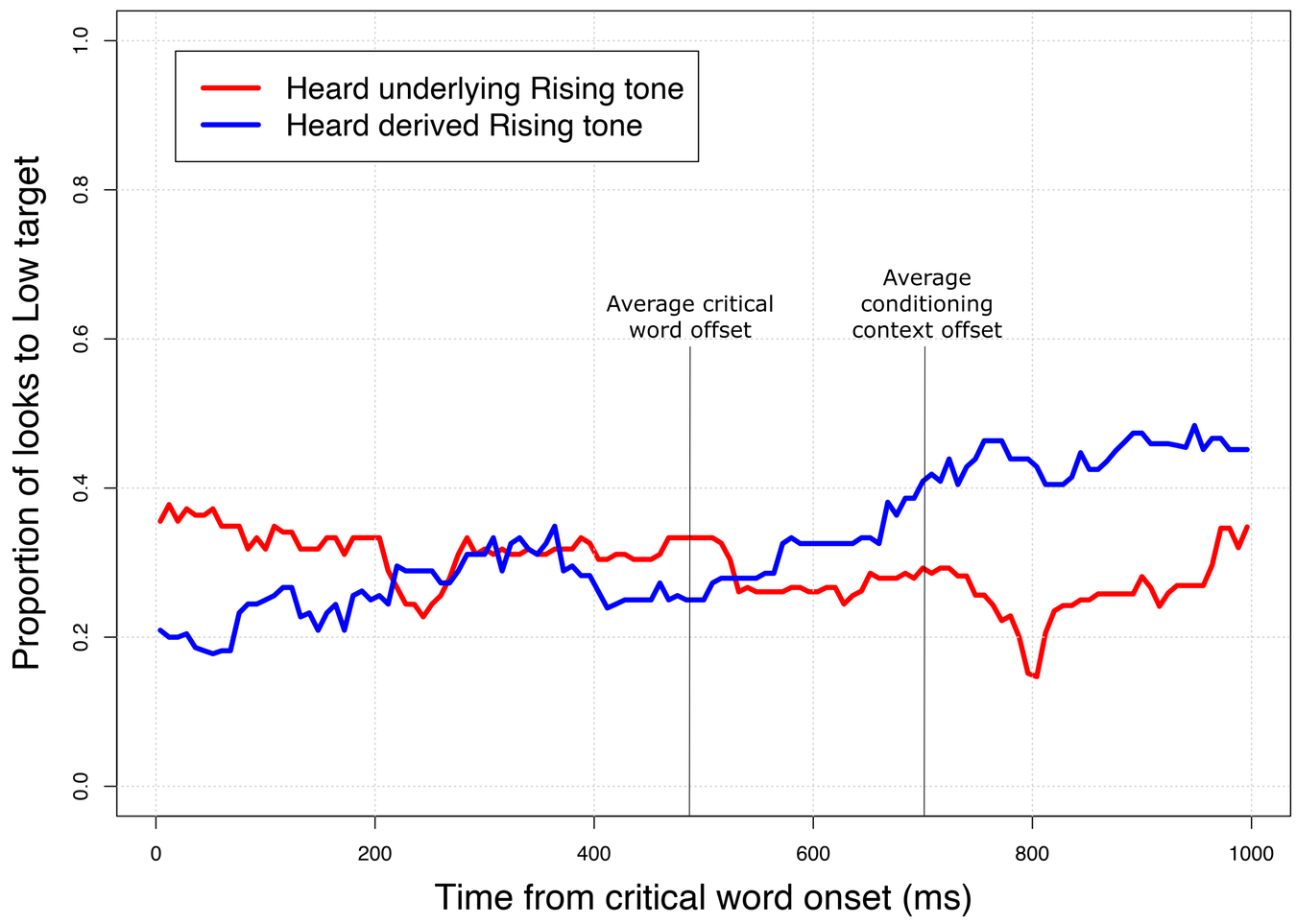


***Figure 2*:** Eye-tracking grand averages

Discussion

Behavioural findings

- Participants were not able to reliably select the intended picture, replicating previous offline results

Eye-movement findings

- Participants were sensitive to the difference
  - Participants looked at the Low tone picture more in the Derived Rise compared to Underlying Rise condition
  - This is true only during and after the conditioning context is heard
  - During the critical word, the look to the Low and Rising tone pictures are no different

Suggests that listeners do hear a difference between the Derived and Underlying Rising tones, even if they cannot access it behaviourally

Design challenges

- Recording critical words in the carrier phrase focuses the critical word, making the sandhi optional
  - The sandhi is not being reliably produced by speakers
  - The sandhi may not be expected in an optional context
- We are considering multiple solutions
  - Manipulating naturally produced tokens
  - Recording critical words in disyllables and splicing into carriers

Future work

- Finalize auditory stimuli
- Collect high-powered sample (n=50)
- Include a non-sandhi context condition for comparison

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