

Phonological Representations of Mandarin Tone 3 Sandhi in Advanced Tonal and Non-Tonal L2 Speakers

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While L2 speech perception research has extensively examined acoustic cue use and phonological acquisition, it has largely focused on segmental phenomena, leaving suprasegmental phonological rules relatively underexplored, such as tonal alternations in spoken word recognition.

In Mandarin, tone sandhi involves context-driven tonal alternations, most notably the productive and phonologically motivated Tone 3 sandhi, whereby a low-dipping Tone 3 changes to a rising Tone 2 when followed by another Tone 3. The present study tested whether different learner populations rely on different information sources during lexical access under a single, controlled paradigm.

Method: The design of the stimuli followed Chien et al. (2016). Thirty disyllabic Mandarin T3 sandhi words were selected as critical targets, including 15 high-frequency and 15 low-frequency items. Each target (e.g., /chan3 pin3/ “product”) was preceded by: a T3 underlying tone prime (e.g., /chan3/ “to produce”), a T2 surface tone prime (e.g., /chan2/ “to entwine”), or a T1 control prime (e.g., /chan1/ “to help someone walk”). The critical targets were presented in a Latin Square design. There are also 60 words and 90 nonwords included as fillers.

Thirty native Mandarin speakers (25F, 5M; mean age = 23.67) and forty-two advanced L2 learners (36F, 6M; mean age = 22.57) participated in the study, with the learner group consisting of 21 tonal-L1 and 21 non-tonal-L1 speakers. All learners had passed HSK-5 or HSK-6 (advanced level), and had an average length of residence of 30.84 months.

Results: For native speakers, Fig. 1 showed that T3 sandhi word recognition was significantly facilitated by a T3 underlying-tone prime but not by a T2 surface-tone prime, with responses significantly faster for T3 than for T2 primes ($\beta = 0.03, p < 0.001$).

For tonal L2 speakers, responses were faster for higher-frequency targets ($\beta = -0.06, p < 0.01$), and this frequency effect interacted with prime type ($\beta = 0.05, p < 0.01$). Specifically, surface priming decreased as frequency increased, whereas underlying priming showed no comparable interaction. For non-tonal L2 speakers, there was a significant effect of prime type on reaction times, with T2 surface tone primes eliciting faster responses than the control condition after Tukey’s HSD correction ($\beta = -0.03, p < 0.05$), as illustrated in Fig. 2.

Discussion: First, the priming results of native speakers replicated Chien et al. (2016), while the absence of lexical frequency effect may result from the relatively high frequency of the target items in the present study.

Second, tonal-L1 learners did not show robust evidence of stable underlying-tone access. Instead, their priming pattern was modulated by lexical frequency: surface primes facilitated recognition only for lower-frequency items, and this facilitation weakened as frequency increased. This suggests that tonal-L1 learners dynamically reweight surface tonal cues and lexical knowledge as a function of lexical entrenchment, rather than relying on a single uniform processing route. This pattern is consistent with previous findings that tonal language experience does not guarantee native-like Mandarin tone processing (So & Best, 2010), and with L2 speech-learning accounts in which prior L1 experience shapes cue weighting in L2 word recognition (Escudero, 2009; van Leussen & Escudero, 2015).

In contrast, non-tonal-L1 learners showed facilitation only from T2 surface primes, suggesting reliance on overt surface phonetic information rather than abstract tonal representations. Because this effect was not modulated by lexical frequency and was not accompanied by underlying priming, it points to a relatively stable surface-based access route.

Taken together, the two learner groups appear to differ not simply in degree of success, but in the processing mechanisms they use during lexical access to Mandarin T3 sandhi words.

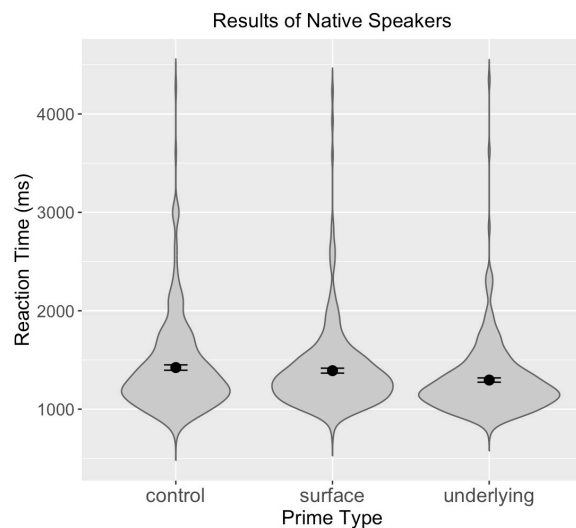


Fig. 1. Distribution of native speakers' reaction time across prime type conditions, visualized with violin plots. Mean RTs are shown as black points, with error bars indicating ± 1 standard error (SE). Violin shapes represent kernel density estimates of the response distributions within each condition.

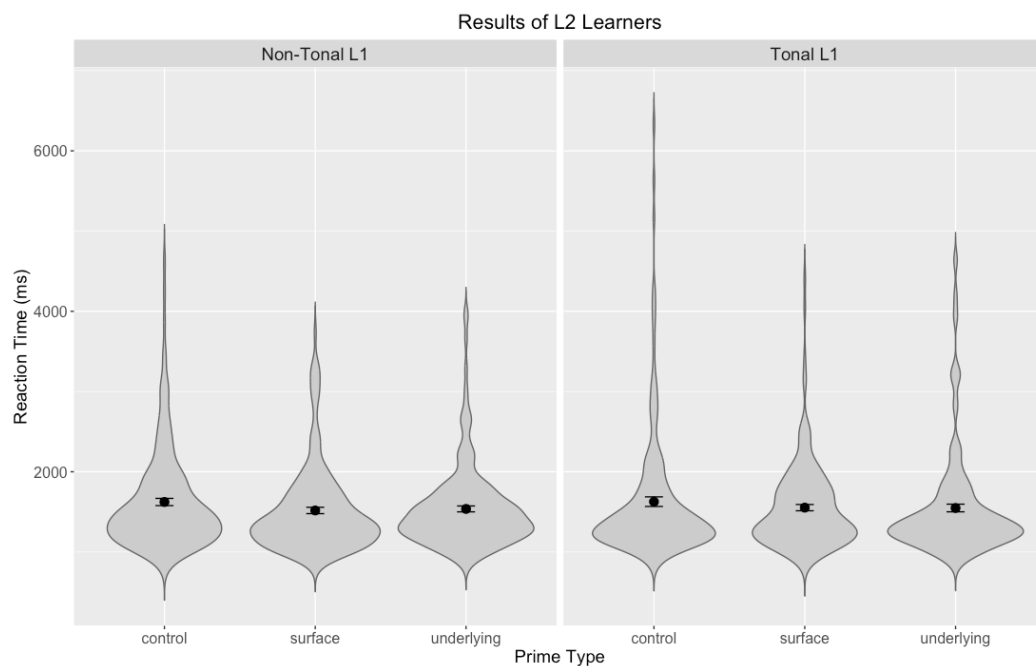


Fig. 2. Distribution of L2 learners' reaction time across L1 backgrounds and prime type conditions, visualized with violin plots (left panel: non-tonal L1, right panel: tonal L1). Mean RTs are shown as black points, with error bars indicating ± 1 standard error (SE). Violin shapes represent kernel density estimates of the response distributions within each condition.

References

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