

Introduction

Tonal alternation is pervasive in Mandarin disyllabic compounds and the best-known example in Mandarin is the T3 ‘tone sandhi’, where the first T3 in a sequence of T3-T3 words obligatorily changes from a low dipping tone (T3) to a rising tone (T2). Although this phenomenon has been extensively studied in previous work (Chien, Sereno, & Zhang, 2015; Sereno & Lee, 2015; Zhou & Marslen-Wilson, 1997), the representation of T3 sandhi in the mental lexicon remains controversial.

Different views exist regarding how T3 sandhi words are represented in the mental lexicon: that is, whether they are represented in their citation forms (/T3-T3/), in their surface forms ([T2-T3]), or in two surface forms, i.e., both T2 and T3 (cf. Zhou & Marslen-Wilson, 1997).

These different views stem from two central observations:

- First, substantial evidence for the representation of T3 sandhi words comes from form priming experiments; thus the observed priming effects might be due to acoustic similarities between T2 and T3 rather than a real priming effect (Chien et al., 2015; Politzer-Ahles et al., 2018).
- Second, it is difficult to tell whether the observed facilitatory effects are due to activation or reduced competition (Zhou & Marslen-Wilson, 1995).

The current study investigates how T3 sandhi words are represented with the aim of providing a better understanding of the factors that may underlie the priming effects found in previous studies.

Research Questions

- What drives the facilitation effects found in previous studies?
- Is the priming effect due to phonological similarities between primes and targets?
- How are T3 sandhi words represented in the mental lexicon?

Methods

Three separate cross-modal (auditory primes, visual targets) lexical decision experiments were conducted:

- In Experiment 1 (form priming task), non-sandhi words beginning with T3 were adopted as targets and participants were asked to make lexical decision after auditory primes containing T2, T3, or T4.
- In Experiment 2 (semantic priming task), the disyllabic targets could be anything other than T3 sandhi words and were semantically related only to T3 primes.
- In Experiment 3 (semantic priming task), the disyllabic targets were semantically and tonally unrelated to the T3 primes. However, the mediating prime, which shared the initial tone with the T3 prime, was semantically related to the targets.

Table 1: Sample stimuli for Experiments 1-3

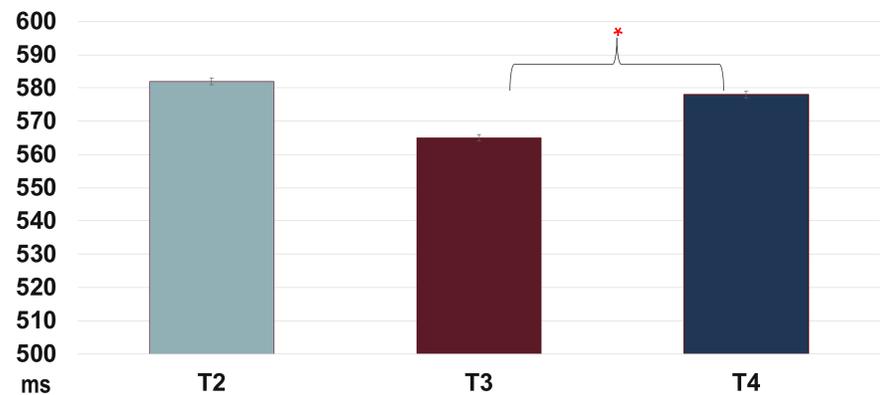
| | Condition | Auditory prime | Mediator | Visual target |
|----------------|--------------------|---------------------|--------------------------------|------------------------------------|
| Exp1 (n=50) | T3 | /fan3/ ‘opposite’ | N/A | 反射 /fan3 she4/ ‘reflection’ |
| | T2 | /fan2/ ‘annoying’ | | |
| | T4 (as control) | /fan4/ ‘meal’ | | |
| Exp2 (n=47) | T3 | /nao3/ ‘brain’ | N/A | 头部 /tou2 bu4/ ‘head’ |
| | T2 | /nao2/ ‘to scratch’ | | |
| | T4 (as control) | /nao4/ ‘noisy’ | | |
| Exp3 (n=50) | T3 | /da3/ ‘to beat’ | 打扫 /da3 sao3/ ‘to clean’ | 清理 /qing1 li3/ ‘to clean up’ |
| | T2 | /da2/ ‘to answer’ | | |
| | T4 (as control) | /da4/ ‘big’ | | |

Results

Analysis

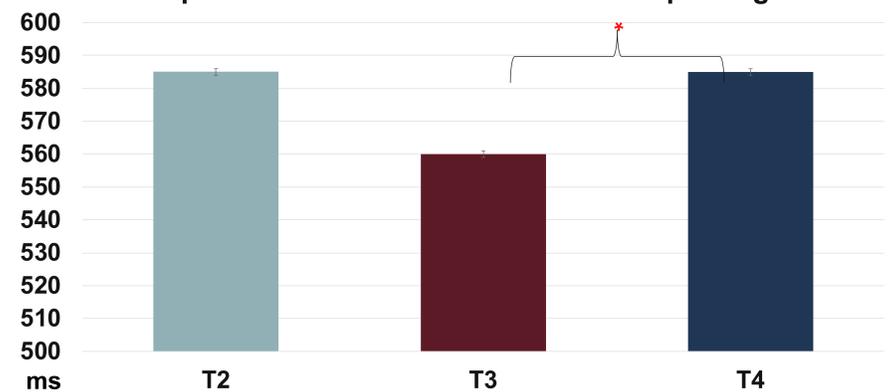
In all three experiments, reaction times were analyzed using linear mixed effect modelling with *Prime tone* (T2, T3 or control T4) and *Lexicality* (of T2 primes: word or nonword) as independent factors and the random factors *Subject* and *Item*.

Experiment 1: Form priming with non-sandhi target



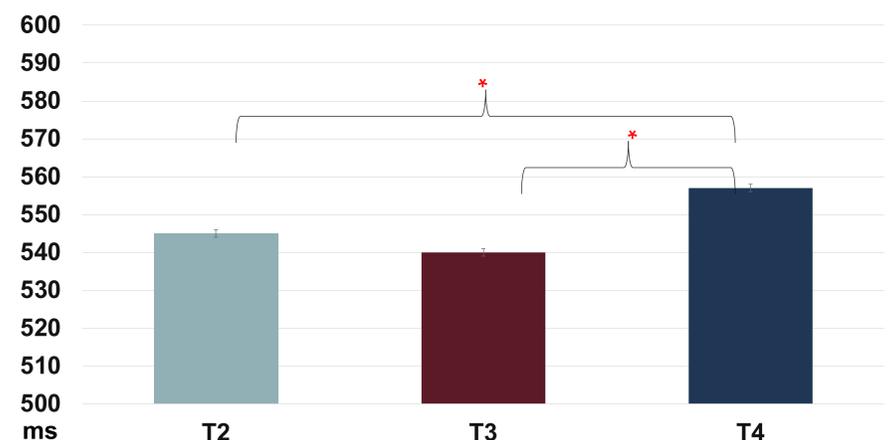
- T3 primes significantly facilitated the processing of targets compared to T4 controls.
- RT between T2 and T4 did not differ significantly.

Experiment 2: Non-mediated semantic priming



- T3 primes facilitated the processing of targets significantly compared to T4 controls.
- No difference between T2 primes and T4 controls.

Experiment 3: Semantic priming with sandhi mediation



- Both T3 and T2 primes successfully facilitated the targets mediated via the semantically related sandhi words compared to T4 controls.
- T2 and T3 primes did not differ significantly in facilitating the targets through T3 sandhi mediators.

Discussion

- Findings from Experiment 1 indicate that, despite phonetic similarity observed in previous studies, an isolated T2 cannot prime a target beginning with T3 in non-sandhi context.
- Experiment 2 demonstrates that T2 primes do not activate targets which are semantically related to T3 primes. Thus, when no contextual information can be accessed, transfer from T2 to T3 is blocked.
- Experiment 3 shows that T2 primes can facilitate the processing of targets when mediating words serve as a neutralization context, while the facilitatory effect failed to be observed when the contextual information was absent (as in Experiment 2).
- Overall, the results suggest that T2 and T3 primes map differently onto the underlying representation depending on whether the target contains appropriate phonological information to justify the neutralization. When such information is present, both T2 (surface tone) and T3 (canonical tone) activate the lexical entry, whereas when relevant context is absent, only T3 activates the lexical entry and T2 does not.

Contact

<http://brainlab.clp.ox.ac.uk>
yaxuan.meng
@ling-phil.ox.ac.uk

Selected References

Chien, Y. F., Sereno, J. A., & Zhang, J. (2015). Priming the representation of Mandarin tone 3 sandhi words. *Language, Cognition and Neuroscience*, 31(2), 179-189. Politzer-Ahles, S., & Zhang, J. (2018). Evidence for the role of tone sandhi in Mandarin speech production. *Journal of Chinese Linguistics monograph series no. 25*, in press. Sereno, J. A., & Lee, H. (2015). The Contribution of Segmental and Tonal Information in Mandarin Spoken Word Processing. *Language and Speech*, 58 (2), 131-151. doi: 10.1177/0023830914522956. Zhou, X., & Marslen-Wilson, W. (1995). Morphological structure in the Chinese mental lexicon. *Language and Cognitive Processes*, 10, 515-600. doi: 10.1080/01690969508407114. Zhou, X., & Marslen-Wilson, W. (1997). The Abstractness of Phonological Representation in the Chinese Mental Lexicon. In *Cognitive Processing of Chinese and Related Asian Languages*, Chen, H. C. (ed), 3-27. Hong Kong: The Chinese University Press.

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