

Morphemes, phones and phonological alternation: Retrieving lexical semantics and tonal representation of opaque words in Mandarin Chinese

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Within a lexical unit that involves phonological alternation, individual morpheme often gets realized in multiple surface representations, leading to a deviation from its underlying form. In this study, we investigate the lexical access of disyllabic Mandarin tone 3 sandhi words (i.e., /tone3-tone3/ → [tone2-tone3]). In particular, we focus on whether semantic transparency of the word influences how native speakers access multiple tonal forms of the initial morpheme.

The present study consisted of two lexical decision priming experiments, both using *monosyllabic words as targets* and four types of *disyllabic words as primes* (presented in a Latin Square design): unrelated, transparent, opaque and identical (Table 1). Transparent and opaque primes were selected based on pre-conducted semantic relatedness ratings (scale 1-7).

Experiment 1: Phonological priming. Using an *auditory-auditory* priming paradigm (ISI=250ms), the first experiment contained two separate blocks: while both transparent and opaque primes were auditory tone 3 sandhi words, block A (Exp1a) used auditory monosyllabic T3s (N=20) as target words, matched with the underlying tones of the two prime types on the initial syllables, and block B (Exp1b) used auditory monosyllabic T2s as targets (N=20), matched with the surface tones. Participants (N=34) completed two blocks in a counterbalanced order. As detailed in Table 2, **Exp1a** revealed significant facilitatory priming effects in the transparent and opaque primes, relative to the unrelated one; and no significant difference was found between the transparent and opaque conditions ($t=-0.367$, $p=0.714$). In contrast, **Exp1b** showed significant inhibitory priming effects in both transparent and opaque primes, with no significant difference between them ($t=0.391$, $p=0.696$). There are two possible explanations to account for these findings: first, disyllabic Chinese compounds, be it transparent or opaque, were decomposed into two tone 3 morphemes during lexical access, hence facilitating the access of a subsequent tone 3 target (Exp1a) but inhibiting the access of a tone 2 target (Exp1b); alternatively, participants accessed compounds as a whole, regardless of semantic transparency, but they could make phonological inference on the initial syllable by “rewriting” the surface tone 2 into an underlying tone 3 [1, 2, 3], and the converted underlying tone thus hindered the access of a subsequent tone 2 target (Exp1b) by forming a competition. In order to tease apart these two explanations, a second experiment featuring morphological processing of disyllabic Chinese compounds was conducted.

Experiment 2: Semantic priming. The second experiment (subject N=46) used a *visual-visual* priming paradigm. Forty monosyllabic visual words were used as targets. Visual targets were semantic mediates of either the 1st or 2nd constituent of a transparent and opaque prime word and were visually presented for 200ms (Table 1). The results showed a significant facilitatory priming effect induced by the transparent primes whereas a null effect in the opaque ones (Table 2); also, there was a significant RT difference between the two priming conditions ($t=-2.006$, $p=0.045$). Results of Experiment 2 indicate that semantically transparent compounds are decomposed into individual morphemes but opaque words are accessed as a whole unit. This finding rules out the first possible interpretation in Experiment 1.

Conclusion. Findings of the two experiments allow us to postulate that whole-word processing mechanism does not prevent native Mandarin speakers from accessing the underlying phonological form of the constituent, likely because they are able to compute the word-level surface representation into its underlying form. Taken together, our study supports the canonical representation view that disyllabic tone 3 sandhi words are accessed as /tone3-tone3/, in line with some prior studies such as [4], even for opaque sandhi words in which individual morphemes are not enlisted in the mental lexicon.

Table 1. Sample stimuli of Experiment 1a (top), 1b (middle) and 2 (bottom)

Target	Unrelated	Transparent	Opaque	Identical
ma3 'horse'	/chu1-chan3/ 'to produce' (literal: out-produce)	/ma3-wei3/→[ma2-wei3] 'pony tail' (literal: horse -tail)	/ma3-tong3/→[ma2-tong3] 'toilet' (literal: horse -bucket)	/ma3-che1/ 'carriage' (literal: horse -car)
lao2 'labor'	/xiao1-du2/ 'to disinfect' (literal: remove-poison)	/lao3-you3/→[lao2-you3] 'old friend' (literal: old -friend)	/lao3-shu3/→[lao2-shu3] 'rat' (literal: old -rat)	/lao2-dong4/ 'labor' (literal: labor -move)
洋 'ocean'	畏惧 'fear' (literal: fear-fear)	海峡 'strait' (literal: sea -gorge)	海报 'poster' (literal: sea -report)	洋流 'ocean current' (literal: ocean -flow)

Note: Within each experiment, frequencies (and stroke counts in Exp2) of prime words in each priming condition were matched ($ps>0.05$).

Table 2. LogRTs in Experiment 1a (top), 1b (middle) and 2 (bottom)

	Unrelated	Transparent	Opaque	Identical
Mean (SD)	6.953 (0.250)	6.815 (0.298)	6.808 (0.298)	6.753 (0.293)
p	Reference level	< 0.001***	< 0.001***	< 0.001***
Mean (SD)	6.915 (0.251)	6.979 (0.259)	6.993 (0.262)	6.780 (0.289)
p	Reference level	< 0.001***	< 0.001***	< 0.001***
Mean (SD)	6.304 (0.203)	6.287 (0.199)	6.302 (0.201)	6.267 (0.212)
p	Reference level	0.045*	0.993	< 0.001***

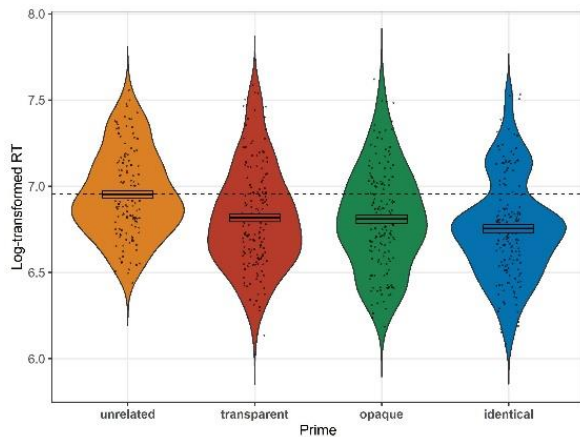


FIGURE 1a. Data visualization in Experiment 1a (monosyllabic tone 3 targets)

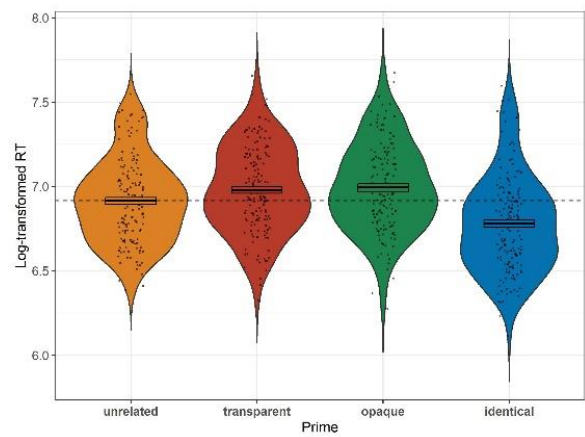


FIGURE 1b. Data Visualization in Experiment 1b (monosyllabic tone 2 targets)

References

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