Representation of Allophonic Tone Sandhi Variants

Yiya Chen, Rachel Shen, Niels Schiller
Leiden University
contact: yiya.chen@hum.leidenuniv.nl

Variation in spoken word realization is ubiquitous in connected speech and presents challenges for theories of linguistic representation and lexical processing. Most previous studies have approached this variability issue from the perspective of *spoken word recognition,* mainly focusing on *segmental* alternations (e.g. Lahiri & Marslen-Wilson, 1991). We report upon a study designed to examine alternations in *tonal* realization during *spoken language production*.

In many tonal languages, particularly Chinese dialects, lexical tones are realized with different allophonic pitch contours in different tonal contexts, known as tone sandhi (Chen, 2000). The question addressed here is whether tone sandhi variants are represented in the mental lexicon and consequently, how they are encoded during speech production. Three experiments were designed to examine one specific tone sandhi variant (i.e. the Sandhi Rising or SR) in Beijing Mandarin (BM) where in a sequence of two lexical Low tones (within certain prosodic domain), the first L is realized with a rising pitch contour (SR), very similar to the rising contour of the lexical Rising tone (R). We aimed to tease apart three possibilities for the representation and phonological encoding of the SR variant. One is that SR is not stored in the mental lexicon. During phonological encoding, it is generated as a lexical Rising tone from the lexical Low tone (***H1: SR = R***). Another possibility is that SR is not stored in the mental lexicon but generated as a new surface tonal category, different from both the lexical Low and Rising tone (***H2: SR ≠ R/L***). A third possibility is that SR is stored in the mental lexicon. SR and L are processed as the same abstract LOW tone (***H3: SR = L***) during phonological encoding.

We employed the *form preparation paradigm* (Meyer, 1990) and tested eighteen bi-syllabic response words, with three tonal sequences (R+L, L+L, L+R). Three experiments were constructed with each including a subset of the stimuli. (Exp. 1 includes the tonal sequences of L+L, R+L; Exp. 2 L+L, L+R; and Exp. 3 R+L, L+R.) Within each experiment, the stimuli were grouped into different types of sets depending upon their segmental and tonal sharing of the first syllable in the response words. A so-called homogeneous set shares both segments and tone of the first syllable (S+T); a so-called odd-man set shares segments of the syllable and possibly tone, depending on the representation and processing of the Sandhi Rising variant (as predicted in Table I). Sixty native speakers of BM (20 for each experiment) participated in the study. Reaction time data were analyzed using linear mixed effects regression modeling (Baayen et al, 2008).

The tonal sequences L+L and R+L showed only a preparation effect of segment sharing, similar to results of the control experiment where the tonal sequences of L+ R and R+L only share segments. The sequences of L+L and L+R, however, showed a preparation effect of both segment and tonal sharing. The results are thus compatible with the third possibility that the sandhi variant and non-sandhi Low tone are processed as the same abstract LOW tone during phonological encoding, suggesting that the mental lexicon contains both abstract tonal categories and their allophonic variants.

	Predictions for the odd-man condition		
SR representation	Exp.1 L+L, R+L	Exp.2 L+L, L+R	Exp.3 R+L, L+R
SR = R	S + T	S	S
SR ≠ R or L	S	S	S
SR = L	S	S + T	S

Table I. Predictions of the segmental (S) and tonal (T) sharing properties for the so-called odd-man condition in Experiments 1-3 where S+T means that the response words share both segments and the lexical tone of the initial syllable, S means segmental sharing only

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