Cross-generational variability of laryngeal contrasts in Shuangfeng Xiang Chinese

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Languages differ in their utilization of acoustic and articulatory cues to signal laryngeal contrasts[1]. Most studies thus far have examined non-tone languages with a binary system of laryngeal contrast. A handful of studies on Asian tone languages show that the number of laryngeal contrasts, their phonetic realizations, and the effect of laryngeal contrasts on the f0 patterns of their following vowels are typically more complicated than that in non-tone languages[2][3][4][5]. We report data which suggest that the phonetic realizations of multiple laryngeal contrasts can also vary across speakers of different generations within the same language. Understanding those complex interactions can help us gain insights into tonogenesis and the evolution from laryngeal contrasts to tonal systems.

Shuangfeng Xiang Chinese (SF hereafter), a Sinitic tone language, features a three-way laryngeal contrast in obstruents (unaspirated, aspirated, and voiced), which interacts with a five-way lexical tonal contrast (h-level, l-rising, h-falling, h-rising, and l-level, T1 to T5 hereafter), as plotted in Figure 1. T1, T3, and T4 only co-occur with voiceless onsets, while T5 occurs exclusively with voiced onsets. T2, however, can co-occur with all three-way onsets. In addition, phonation has been argued to serve as an important cue for signaling the voiced onsets[6]. Given the three-way contrast in VOT, the co-occurrence of lexical tones with consonant onsets, and the potential effect of onset voice quality on the following vowel in SF, we bring in empirical data to examine (i) how the phonetic cues interact to give rise to the laryngeal contrasts; and (ii) how speakers of different generations may utilize and weight the cues differently.

Two repetitions of a total of 20 morphemes were produced by speakers of two generations (22 old speakers with an average age of 58 yr vs. 15 young speakers with 35 yr). These morphemes consist of two items under each laryngeal condition of the five lexical tones. Acoustic and electroglottothograph (EGG) signals were recorded simultaneously. Three parameters – voice onset time (VOT) of the onset as well as fundamental frequency (f0) and laryngeal contact quotient (CQ) of the following vowel – were analyzed. Principal component analysis (PCA) and multilevel regression models (i.e., GCA, GLMMs, and LMMs) were applied to data analyses.

Results suggest a relatively stable phonological distinction of the three-way laryngeal contrast across generations. On the one hand, the f0 contours following aspirated onsets were consistently lowered relative to those following unaspirated onsets. On the other hand, the unaspirated onsets were consistently realized with shorter VOT and higher CQ, compared to that after aspirated onsets. The voiced onsets consistently co-occurred with low f0 contours but their realizations showed varied relationships between VOT and CQ across the two generations of speakers. The old-generation speakers produced predominately negative VOT without significant differences in the following vowel’s CQ, while the young-generation speakers produced fewer negative-VOT tokens and decreased CQ. Conjointly, our results show that cues (i.e., f0, VOT, and phonation) for laryngeal contrasts are interdependent, and the utilization of these cues can vary across generations. The changing relationship between laryngeal timing and phonatory state suggests a possible intermediate stage from voicing contrast to tonal contrast, lending support to the laryngeally-based model of tonal development[7].
Figure 1: $f_0$ contours of the five lexical tones in SF (measured at 20 equidistant points). Light gray areas indicate ±SE.

References


