

Cues of voicing contrast in two Chinese dialects: Implication for sound change

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Obstruent voicing contrast is known to differ along multiple phonetic dimensions. Languages differ not only in which cues are relevant for their voicing contrast but also in the relative weighting of these cues (e.g., Lisker & Abramson, 1964; Repp, 1982). A widely observed case is the cue covariation between the voice onset time (VOT) of an obstruent onset and the fundamental frequency (f_0) of its following vowel (e.g., House & Fairbanks, 1953 for English; Kang, 2014 for Korean; Coetzee et al., 2018 for Afrikaans). The relationship between VOT and f_0 is often linked to tonogenesis (e.g., Hyman, 1976; Hombert et al., 1979): Onset-induced f_0 differences are exaggerated and become distinct tones, while onset voicing distinction can be either lost (e.g., Sgaw Karen, Haudricourt, 1972) or maintained (e.g., Cao Bǎng Tai, Pittayaporn & Kirby, 2017). The existence of the latter type of languages suggests that there may exist additional intermediate stages between the rise of the novel phonologized f_0 differences as tonal contrast and the fall of the original voicing contrast. One question we address here is how these languages maintain the co-occurrence of the obstruent voicing contrast and lexical tonal contrast over time, answers to which would shed new light on tonal genetic processes in general.

In this study, we present data from two under-documented Chinese dialects (i.e., Shuangfeng Xiang and Lili Wu), where voicing contrast and lexical tonal contrast have been reported to co-exist. Moreover, phonation has been argued to serve as an important cue for the voicing contrast in both dialects (Zhu & Zou, 2017 for Shuangfeng Xiang; Zhu & Xu, 2009 for Lili Wu). Minimal pairs of laryngeal onsets (i.e., voiceless unaspirated vs. voiced) were recorded (with 5 pairs in Shuangfeng Xiang and 12 pairs in Lili Wu). Acoustic data and the simultaneous Electroglottograph (EGG) signal were recorded to separate channels. A total of 37 speakers of Shuangfeng Xiang and 20 of Lili Wu produced the stimuli. These participants can be classified into two different generations (old vs. young). Three sets of parameters were measured, namely f_0 contours, VOT, and contact quotient (CQ), which is defined as the ratio of the duration of the contact phase to the period of the vibratory cycle and has been shown to be a reliable cue to capture phonatory states in a related Wu dialect (Tian & Kuang, 2019). Multilevel regression models (i.e., GCM, GLMMs, and LMMs) and principal component analysis (PCA) were applied to data analyses.

Our results showed that onsets from the voiced category consistently co-occurred with lower f_0 contours across dialects and generations. Interestingly, the relationship between VOT and CQ was found to vary. In Shuangfeng Xiang, the old-generation speakers produced predominately negative VOT without significant differences in the following vowel's CQ. The young-generation Shuangfeng Xiang speakers, however, produced fewer negative-VOT tokens, which also tended to be shorter. Furthermore, they showed decreased CQ over the first half of the vowel after voiced obstruents. In Lili Wu, the old-generation speakers produced all "voiced" obstruents with positive-VOTs but with a significantly lower level of CQ over the first half of the following vowel. The young-generation speakers also produced positive-VOTs over the "voiced" obstruents but with increased CQ over the first half of the following vowel. If no strategy of enhancement is taken by the younger speakers of Lili Wu, the loss of breathiness can potentially weaken the distinctness of voiced obstruents, leading to the neutralization of the voicing contrast. Table 1 summarizes the four different relationships between VOT and CQ to signal the voiced category in both dialects.

The different relationships between laryngeal timing (in terms of VOT) and phonatory state (in terms of CQ) highlight possible pathways for changes of cue weighting in the phonetic implementation of voicing contrast in Asian tonal languages. Such relationships between VOT and CQ shed further light on possible intermediate stages in languages developing from voicing contrast to tonal contrast during sound change.

Table 1 The different relationships between VOT and CQ to signal the voiced category in Shuangfeng Xiang and Lili Wu Chinese.

Dialect	Generation	VOT	CQ
Shuangfeng	Old	negative (82%)	higher
	Young	negative (59%)	lower
Lili	Old	positive (100%)	lower
	Young	positive (100%)	higher

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