

## The psychoacoustics and production of Yue lexical tones by Wu and Minnan speakers

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The acoustic and perceptual characteristics, along with the number of lexical tones, vary across different Chinese dialects. For example, Hong Kong Yue (Cantonese) Chinese phonemically distinguishes six tones, whereas Shanghai Wu phonemically distinguishes only three. These characteristics are derived primarily from vocal fold vibration or fundamental frequency (F0) contour and F0 height (Jongman et al., 2006). In addition to F0 differences, several studies have reported temporal differences across tones (Dreher and Lee, 1966; Kratochvil, 1971).

This study explores if familiar and foreign F0 contours, F0 heights and temporal differences can be discretely perceived and reproduced by speakers of a similar, albeit unintelligible tonal dialect. To answer this question, we investigated the perception and production of Hong Kong Yue lexical tones by native Taiwan Minnan and Shanghai Wu speakers. A native Yue speaker recorded six segmentally identical carrier sentences in which only the target syllable's lexical tone varied. Speech tokens were randomly chosen and played to four native Taiwanese Southern Min speakers and two native Shanghai Wu speakers. Using a counterbalanced design, subjects were asked to determine whether paired targets were perceived as identical or different, as well as to reproduce the utterances they had just heard. All tokens were recorded and analyzed using the sound editing software "Praat" in order to measure and extract syllable duration, F0 contour and F0 height for statistical analysis. Additionally, each non-native reproduction was played for five native Yue speakers in order to receive a native speaker tonal judgment rating.

The findings of this experiment suggest that there is no one particular acoustic feature that speakers of a Chinese dialect use to correctly perceive or produce Yue lexical tone, but rather that an amalgamation of salient features, including F0 height, F0 contour and pitch duration exist which speakers are able to draw from. Furthermore, the productions of non-native Yue speakers in tandem with the ratings by native Yue speakers, suggest that certain features are more robust for certain tones. For example, F0 contours contribute to accurate reproduction of low level and rising tones, while F0 levels are important in that of high level and rising tones. Results are discussed in terms of speaker's familiarity with specific F0 contours and the ability to integrate specific psychoacoustic information.

Dreher, J. and Lee, P.C. (1966). Instrumental investigation of single and paired Mandarin tonemes. *Research Communication 13*, Douglas Advanced Research Laboratories.

Jongman, A., Wang, Y., Moore, C., and Sereno, J.A. (2006). Perception and production of Mandarin tones. In: Ping Li, Li Hai Tan, Elizabeth Bates, and Ovid J.L. Tzeng (editors), *Handbook of East Asian Psycholinguistics*. Volume 1: Chinese. Cambridge, UK: Cambridge University Press. Pages 209-216.

Kratochvil, P. (1969). Syllabic volume as acoustic correlate of perceptual prominence in Peking dialect. *Unicorn 5*, 1-28.