

## Pitch accent and the three-way laryngeal contrast in North Kyungsang Korean

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Korean is typologically unusual in that it has a three-way contrast between phonetically voiceless stops in word-initial position. The three different categories are often called *fortis*, *lenis*, and *aspirated*, and they are differentiated by both voice onset time (VOT) and fundamental frequency ( $f_0$ ) on following vowels [1,2,3,4]. VOT is shortest for fortis, intermediate for lenis, and longest for aspirated (fortis < lenis < aspirated). The fortis and aspirated categories have higher  $f_0$ , while the lenis category has lower  $f_0$  on the following vowels (lenis < fortis, aspirated).

Traditionally, VOT was considered to be the primary acoustic correlate to the stop distinction [5], while  $f_0$  was considered to be a redundant cue [3,6,7,8]. However, recent studies have reported that Korean stops are undergoing a diachronic sound change and that VOT values of lenis and aspirated stops have merged due to a lengthened VOT for lenis stops and a shortened VOT for aspirated stops [8]. As a result, the distinction between the lenis and aspirated stops is now coded primarily by an  $f_0$  difference on the following vowels [4,7,8,9].

The new pattern is generally observed in Seoul Korean, but not all dialects in Korea are reported to have undergone this change. The South Kyungsang (SK) dialect, one of two Kyungsang dialects which retain the pitch accent system from Middle Korean, has not undergone the change, and even younger speakers keep the traditional pattern [10]. Lee, Politzer-Ahles & Jongman [9] assert that VOT is still used as a main cue of the stop distinction in the SK dialect since  $f_0$  is already used for the pitch accent system.

However, the change seems to be happening in North Kyungsang (NK) even though the NK dialect is a pitch accent dialect. Holliday & Kong [11] reported that female speakers of the NK dialect have more VOT overlap between the lenis and aspirated stop categories than male speakers. Very little other work on the NK dialect exists, however, raising questions about how robust this sound change is in NK and how it is progressing. With this in mind, we report on an apparent time study investigating the change-in-progress affecting VOT and  $f_0$  in NK stop consonants and its interaction with the pitch accent system. To examine age and gender effects, 4 groups of native NK speakers were included: 6 older males, 5 older females, 6 younger males, and 6 younger females ( $N = 23$  talkers). Stimuli include 36 bisyllabic words with Low-High and High-Low tone patterns beginning with bilabial, alveolar, and velar stops of each of the three types (fortis, lenis, and aspirated) in the onset of the first syllable embedded in a carrier sentence. VOT measured from stop burst to the onset of periodicity and average  $f_0$  extracted from the 10% point of the following vowel are reported.

The results indicate that the four groups of talkers are in different stages of the VOT change. The younger groups and the female talkers are more likely to produce the innovative pattern, with longer lenis and shorter aspirated VOT values (meaning lenis and aspirated pattern together). For  $f_0$ , younger speakers tend to have greater  $f_0$  differences for the stop distinction than older speakers. Aspirated stops are not well differentiated from lenis stops by VOT for many younger speakers and for these speakers  $f_0$  differences are larger. Younger speakers also have a more minimal  $f_0$  distinction between High and Low tones than older speakers.

In addition, we found evidence that there is an interaction between VOT and the tone contrast in the pitch accent system, such that VOT varies by tone category. This study provides evidence that despite the fact that the NK dialect is a pitch accent dialect there can still be the diachronic change in the stop distinction, and that the laryngeal contrasts are becoming merged into the tonal system.

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