Voice Timing in Korean Stops*

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Linguists have disagreed over the features distinguishing the three manner categories of Korean plosives. The three categories of labial, apical, and dorsal stops and palatal affricates are variously described for initial position, using one or more of the following terms: I. Voiceless, tense, long, and glottalized; II. Voiceless, lax, and slightly aspirated; III. Voiceless, heavily aspirated, and lax by some but tense by others. A further complication is the frequent voicing of Category II in a medial voiced environment.

We have devoted much of our research effort to questions of laryngeal control in stop consonants. We have shown that various conditions of voicing and aspiration in word-initial stops in a wide variety of languages depend upon differences in voice-onset time (VOT), the temporal relation between stop release and onset of glottal pulsing (Lisker and Abramson, 1964). Some aspects of the conflicting descriptions of Korean plosives suggested that we test the efficacy of VOT in that language. Combining data from our 1964 study with some recent additions, we present VOT measurements for two native Korean speakers' initial apical stops in Figure 1. The abscissa shows VOT in intervals of 10 msec; zero represents the moment of stop release. The ordinate shows the frequency distribution of VOT values for each of the three categories. Although Speaker B tends to have slightly higher values, the overall results are quite comparable for the two speakers and for the labial and dorsal stops not shown in the figure. Category III is well separated from the others, but I and II overlap somewhat. Similar data have been published by others (Kim, 1965; Han and Weitzman, 1970). Of course, where II assimilates to preceding voicing in medial position, VOT separates all three categories.

The foregoing mixed results made us wonder to what extent VOT might provide sufficient perceptual cues for discriminating the three categories. Also, having shown the perceptual efficacy of VOT for Thai, Spanish, and English (Lisker and Abramson, 1970), we wished to extend our comparative phonetic investigation of the dimension to Korean by studying perception as well as production. Lest we later find instability in the phonological distinctions of concern to us, we proved that randomized words differing only in initial stop categories could be identified with ease. We then exposed native speakers to a continuum of synthetic VOT variants ranging from a voicing lead of 150 msec before the release of the stop to a voicing lag of 150 msec after the release, for identification as

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KOREAN INITIAL STOPS
(Apical)

Fig. 1
Korean syllables at each place of articulation. There were two experimental conditions: (1) a restricted range with all voicing lead variants excluded, thus apparently simulating spoken Korean; (2) the full continuum, thus including variants found only in non-initial position in the spoken language. The range is divided into 10-msec steps except for the portion from a lead of 10 msec to a lag of 50 msec, which is divided into 5-msec steps.

We present labelling responses for the synthetic apical stops only, but the data are typical of all three places of articulation. Figure 2 contains the identification curves for the restricted range. Values of voicing lag are indicated along the abscissa and percent identification as each stop along the ordinate. The left half of the figure is blocked out to show that no lead variants were used. The five subjects responded to the stimuli in three ways. At the top of the figure we see that HL called the variants from 0 to 50 msec Category I and the rest, Category III; he heard none as II. The middle display shows a partition of the range into I, II, and III, in that order; these three subjects, then, behaved much as if VOT were a straightforward cue. At the bottom of the figure, YH divides most of the stimuli between II and III, while weakly favoring I only at 60 and 70 msec.

The responses to the full continuum, including the lead variants marked with negative VOT values, are given in Figure 3. Three response patterns are shown by the four subjects. At the top of the figure, BC simply divides the range into I, II, and III, but with occasional labelling of lead variants as II. By and large, she would seem to hearing voicing lead as a badly pronounced version of the unaspirated stop. We can perhaps understand her vacillation by looking at the middle of Figure 3. There we see two subjects who yielded the startling result that only variants with voicing lead were heard as II, while the rest of the continuum was divided between I and III. It should be recalled that audible laryngeal pulsing does not occur during initial stop occlusions in Korean; therefore, the obvious interpretation of our data is that, upon detecting such abnormal voicing, at least some Koreans feel they must assign it to the one category that has voiced occlusions in any context at all. This implies that they are somehow aware of glottal pulsing, or the underlying laryngeal gesture, as a component of II. At the bottom of Figure 3, CH not only does the same thing but also assigns several slightly aspirated variants--those from 35 to 80 msec of lag--to Category II.

The complicated response patterns and production data lead us to two inferences: (1) the timing of glottal adjustments relative to supraglottal articulation contributes to the Korean distinctions, and (2) there must be another dimension that works with VOT in distinguishing the categories. An accumulation of acoustic data on the matter has been furnished by Han and Weitzman (1970), and Kim (1965) in addition to Kim's (1965, 1970) physiological data. We are tempted to believe that the difficult question of the distinction between Categories I and II in initial position will be resolved by further examination of laryngeal mechanisms. Recent fiberoptics work by Kagaya (1971) supports this belief. Also, some speakers have quite audible vocal fry or laryngealization in Category I. We plan to take a close look at this phenomenon by means of our fiberoptics system.
KOREAN LABELLING JUDGMENTS
(Stimulus Range: 0/+150 msec.)

Fig. 2
KOREAN LABELLING JUDGMENTS
(Stimulus Range: -150/+150 msec.)

Fig. 3
REFERENCES

Han, M.S. and R.S. Weitzman (1970) Acoustic features of Korean /p,t,k/, /p,t,k/ and /p⁹,th,k⁹/. Phonetica 22, 112-128.


