

## Acoustic qualities as potential boundary cues for segmentation in Korean

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The acoustic information serves an important role in sentence parsing. Several studies showed that voicing qualities of initial stops provided physical cues in segmentation. In Korean, lenis stops (i.e., /p, t, k/) tend to be voiced domain-internally (/k/ in 1a and /p/ in 1b) but not domain-initially (/p/ in 1a and /k/ in 1b). This suggests that in ambiguous cases like (1a-b), the voicelessness of stop consonants associated with a boundary, indicated by ‘|’, may signal whether/where a boundary is present.

Jun (1996 and elsewhere) proposed that lenis stop voicing occurred within the domain of an Accentual Phrase (AP). That is, word/AP-initial stops (/p/ in 1a) would become voiceless but word-initial/AP-internal stops (/k/ in 1b) would be voiced. Consequently, lenis stop voicing can't reveal a word boundary, unless it coincides with a phrase boundary. Instead, Jun suggested a segmental boundary was more identifiable by tonal structures. We propose the alternative that word-initial/AP-internal stops will be voiceless, in particular, if they are focused. In short, this study aims to show that several acoustic qualities including voicing are produced to signal the presence/location of a boundary.

A production experiment was conducted by recording six pairs of sentences like (1a-b). Ten Seoul dialect talkers (five males/females) produced experimental stimuli twice at a natural speaking rate. The stimuli were equally familiar across conditions. The semantic focus information was manipulated by using a question-answer method. The results from off-line focus norming hinted which phrases would be focused in on-line production. For each sentence, voicing qualities (closure duration and VOT) for the two lenis stops (e.g., /k/ and /p/) were measured. F0s of vowels neighboring the stops (e.g., /i/, /a/, /a/) were measured, and f0 contours were examined by connecting means of f0s across the three vowels for each talker.

The presence/location of a boundary (word and phrase) was significantly realized by 1) the voicing quality in which initial stops (/p/ in 1a and /k/ in 1b) produced longer closure durations and VOTs than internal stops (/k/ in 1a and /p/ in 1b), and 2) by f0s in which vowels following initial stops elicited lower f0s than those following word/AP-internal stops. Crucially, as we proposed, focused word-initial stops (/k/ in 1b) were realized voiceless. As in Cho & Keating (2001)'s study, the voicing qualities of initial stops showed structural differences, in that AP-initial stops were more lengthened than word-initial stops. The patterns of f0 contours also showed structural differences in between (1a) type (i.e., H-H-L) and (1b) type (i.e., H-L-H). Finally, the focus information facilitated voicing quality of initial stops by lengthening VOTs, but it suppressed the rise in f0s of vowels.

In sum, acoustic qualities (VOT, f0, and f0 contour) assisted by the focus information were produced as potential cues to signal the presence of a boundary at a word (lexical) level and a phrasal (structural) level. We propose that all information is actively used as constraints in production.

- (1a) Question: Who is in the room? / Where is your sister?  
 Answer: /ənni-ka/ | /paŋ-e/ | /is'əjo/  
 [AP(Word ənni-ka)] | [AP (Word paŋ-e)] | [AP (Word is'əjo)]  
 Sister-NOM room-LOC is  
 (My) sister is in the room.
- (1b) Question: Where is the movie ticket? / Isn't the movie ticket in the sister's bag?  
 Answer: /ənni | **kapaŋ-e/** | /is'əjo/  
 [AP(Word ənni) | (Word kapaŋ-e)] | [AP (Word is'əjo)]  
 Sister-POSS bag-LOC is  
 (It) is in the bag of (my) sister.

#### Reference

- Cho, T., & Keating, P. A. (2001). Articulatory and acoustic studies on domain-initial strengthening in Korean. *Journal of Phonetics*, 29, 155-190.
- Jun, S.-A. (1996). *The Phonetics and Phonology of Korean Prosody: intonational phonology and prosodic structure*. New York: Garland Publishing Inc.