

# Which acoustic qualities related to lenis stops are produced to signify one representation over the other?

ənni /k/ a /p/ a ŋ e is'əjo

- AP {ənni word | /k/a/p/aŋ-e} {is'əjo}
  - sister-(POSS) bag-LOC is
  - (Something) is in (my) sister's bag.
- AP {ənni-/k/a APword | /p/aŋ-e} {is'əjo}
  - sister-NOM room-LOC is
  - (My) sister is in the room.

## Previous studies

- Korean lenis stops /p, t, k/ are distinctive in that
  - [p,t,k] → [b,d,g] / [+voiced] \_\_\_\_ [+voiced]. (Jun, 1996; Shon, 1999)
  - The f0 of vowels following /p, t, k/ is low (Kim, 2002).
- Jun (1996, elsewhere)
  - Lenis Stop Voicing Rule – Lenis stops become voiced within an Accentual Phrase (AP) but not in the beginning of an AP. The tonal structure of an AP is significant in sentence parsing.
- Question:** The voicing quality of the stops would not signal a word boundary unless it coincides with an AP boundary.
- Cho & Keating (2001) – Domain-initial strengthening
  - Domain-initial stops are strengthened (lengthened) to an articulation, and they are more strengthened as the phrasal prosodic domain becomes higher.
- Question:** Is there another factor, such as focus, which may contribute to the strengthening of domain-initial stops?

## Research Questions

- Which acoustic qualities are produced to signal the presence of a boundary at the word (lexical) and the phrasal level?
- What is the domain for the lenis stop voicing? Is it an AP or a word?
- Which role does the focus information play in segmentation to signify the presence of a boundary?

## Production Experiment

### Talkers

- Five female and five male Seoul-dialect speakers who were attending The University at Buffalo. The average staying in an English-speaking country was 28 months. The talkers' ages were ranged from 25 to 36 years old.

### Materials

- Six pairs of ambiguous sentences in which two lenis stops were either combined (e.g., /kapaŋ/) or separated (e.g., /ka/ and /paŋ/).
  - Three pairs contained /k/ and /p/ (e.g., /kapaŋ/ vs. /ka/ /paŋ/)
  - Three pairs contained /k/ and /k/ (e.g., /kake/ vs. /ka/ /ke/)
- In each pair, semantic focus information was manipulated by using a question-answer format (Rooth, 1997).

### Norming

- Familiarity norming: Target words (e.g., /paŋ/ vs. /kapaŋ/) were equally familiar across the boundary condition.
- Focus norming: Over 90% of responses were consistent with the experimenter's pool of sentence materials.

### Procedure

- Talkers read target sentences twice as if they had answered given questions.
- Recording was done on a Mac using a microphone. The microphone signal was amplified and digitalized at a 44.1 kHz sampling rate.

# Acoustic Qualities as Potential Boundary Cues for Segmentation in Korean

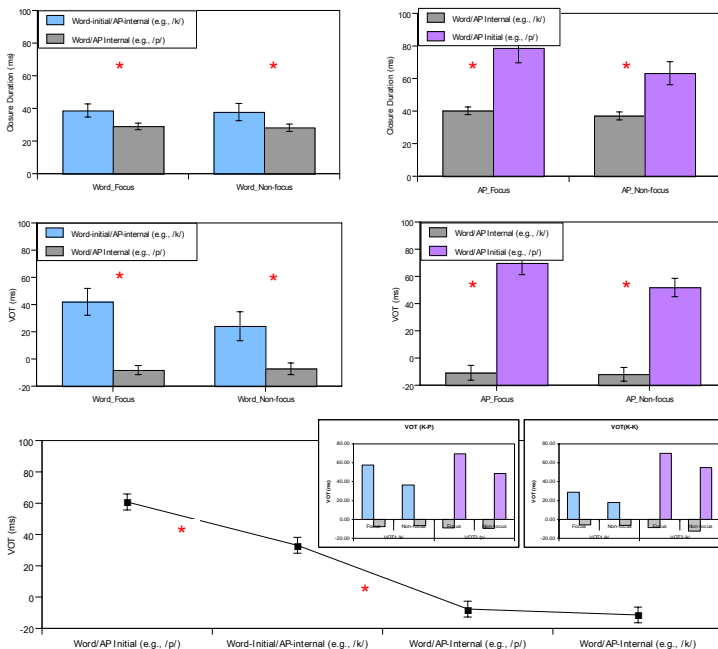
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## Materials (Boundary x Focus)

Word Boundary	Focus	Target	Interpretation
Word	Focus	jəŋhwaŋpjo-ga ədi-e is'əjo?	{ənni   kapaŋ-e} {is'əjo}
	Non-focus	jəŋhwaŋpjo-ga ənni kapaŋ-e əhsəjo?	{ənni   kapaŋ-e} {is'əjo}
AP	Focus	nuga paŋ-e is'əjo?	{ənni-ka   {paŋ-e} {is'əjo}
	Non-focus	ənni-ga ədi-e is'əjo?	{ənni-ka   {paŋ-e} {is'əjo}

## Results - Consonants

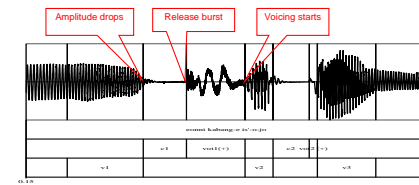


### Results/Discussion

- Initial stops were realized as voiceless (long closure duration and VOT). The VOTs of initial stops became longer as the prosodic domain became higher.
- Focus facilitated the voicelessness of initial stops but not that of internal stops.
- The voicing quality of initial stops assisted by the focus information can signify the presence of a boundary both at the word and phrasal levels.

## Measurements

Word	V1	/k/	/a/	V2	/p/	/a/	V3
Word	Word-initial AP-internal			Word/AP Internal			
AP	Word/AP Internal			Word/AP initial			



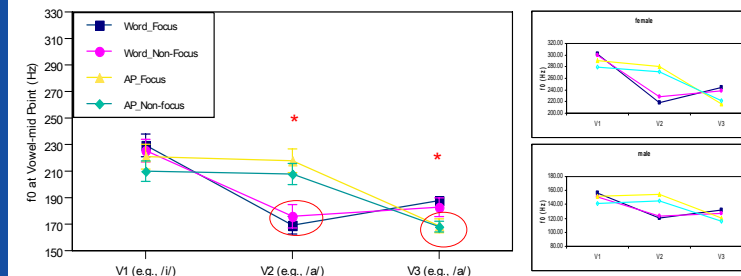
### Consonants:

- Closure duration (Amplitude drops ~ release burst), 2) VOT (release burst ~ voicing starting point)

### Vowels: f0 of vowels before/after consonants

- V1 (\*Onset of vowel ~ Onset of Closure duration)
- V2 (Coda of VOT 1 ~ Onset of Closure duration 2)
- V3 (Coda of VOT 2 ~ \*Coda of vowel) \* was determined by the pattern of spectrogram for each vowel.

## Results - Vowels



### Results/Discussion

- The f0 of vowels following initial stops were low at V2 and V3: f0s of the second vowels were low when they followed word-initial/AP-internal stops (172.54 Hz), and those of the third vowels were low when they followed Word/AP initial stops (168.46 Hz).
- Focus did not contribute to the rise of f0s when vowels followed initial stops.
- F0 contours showed structural differences of target phrases in between the word boundary condition (i.e., H-L-H) and in the AP boundary condition (i.e., H-H-L).

## Conclusion

- Closure duration, VOT, f0, and f0 contour are potential cues which can signal the presence of a boundary at a word (lexical) and a phrasal level.
- Focus also strengthens the acoustic nature of lenis initial stops by lengthening VOTs and lowering f0s.
- The domain for lenis stop voicing can be a word, in particular, when initial stops are focused.
- Lexical, structural, focus information are all used as multiple constraints in production.

## References

Cho, T., Jun, S.-A., & Ladefoged, P. (2002). An acoustic and aerodynamic correlates of Korean stops and fricatives. *Journal of Phonetics*, 30, 193-228.

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.

Kim, M.-R., & Beddor, P. S. (2002). The contribution of consonantal and vocalic information to the perception of Korean initial stops. *Journal of Phonetics*, 30, 77-100.

Rooth, M. (1997). Focus. In S. Lappin (Ed.), *The Handbook of Contemporary Semantic Theory* (pp. 271-297). Oxford, UK: Blackwell Publishers.

Soth, H.-M. (1999). *The Korean Language*. Cambridge: Cambridge University Press.