A chain shift and the initial syllable prominence in Seoul Korean

Yoonjung Kang
*University of Toronto*
Tae-Jin Yoon
*Sungshin Women’s University*
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Questions

• How does the prosodic prominence interact with vocalic chain shifts?

• Do prosodically prominent positions lead the change? Or do prosodically weak positions lead the change?

• What can we learn about the mechanism of a sound change by examining prosodically conditioned variation?
Stress

• **Stressed** vowels:
  – tend to be longer and more likely to reach the articulatory target (**Hyperarticulation**)
  – show a more peripheral realization

• **Unstressed** vowels:
  – tend to be shorter and are less likely to reach the articulatory target (**Hypoarticulation**).
  – show a more centralized realization.

German vowels

Mooshammer and Geng (2008, JIPA)
German vowels

Mooshammer and Geng (2008, JIPA)
Hyperarticulation as a phonetic target

• Most clearly articulated speech is most relevant to phonological analysis.  
  (Jakobson and Halle 1956; Hockett 1955)

• A phonetic target is hyperarticulated and hypoarticulated speech is due to an undershoot of the phonetic target.  
  (Johnson et al. 1993, Language, p.506)
Sound change and phonetic target

• What is the phonetic target of a sound undergoing a change?

• Conservative target?
  – Prominent position = older form
  – Weak position = newer form
  – Change is led by hypoarticulated forms.
  – Phonology lags behind the phonetic change.

• Innovative target?
  – Prominent position = newer form
  – Weak position = older form
  – Change is led by hyperarticulated forms.
  – Phonology leads the change and production follows.
Labov (1994, *PLC*)

- “*[T]he most highly stressed vowels tend to move farther in the direction of the change in progress.*” (p.195)
- This is the case even when the direction of change is not toward a more peripheral position.
Non-peripheral target

• /iy/ centralization and lowering in the speech of Marie Corville (39, London 1968) (p. 173-4)
  – Vowels with emphatic stress are more centralized and lowered (=the target direction of change), while vowels with secondary and tertiary stress are found closer to the periphery.
  – It follows that the connection often made between peripheral position and length is reversed for Marie Colville’s /iy/. The more time the speaker has to enunciate the vowel, the farther the nucleus extends toward the center of the vowel system. (p.174)
Non-peripheral target

- /iy/ centralization and lowering in the speech of Marie Corville (39, London 1968) (p. 173-4)
  - Vowels with secondary and tertiary stress are centralized and lowered, while vowels with primary stress are found closer to the periphery.
  - It follows that the connection often made between peripheral position and length is reversed for Marie Colville’s /iy/. The more the speaker has to enunciate the vowel, the farther the nucleus extends toward the center of the vowel system. (p.174)
Non-peripheral target

- /iy/ centralization and lowering in the speech of Marie Corville (39, London 1968) (p. 173-4)
  - Vowels with peak stress are centralized and lowered (=the target direction of change), while vowels with secondary and tertiary stress are found closer to the periphery.
  - It follows that the connection often made between peripheral position and length is reversed for Marie Colville’s /iy/. The more the speaker has to enunciate the vowel, the farther the nucleus extends toward the center of the vowel system. (p.174)
Emphatic vs. non-emphatic stressed vowels

  - Canadian shift-like change in OH, NC, and WI: Lowering and retraction of /ɪ, ɛ, and ɑ̈/
  - Emphatic (Hyperarticulated) forms are more peripheral, a pattern expected in the absence of change
### Hyperarticulation vs. Hypoarticulation

<table>
<thead>
<tr>
<th>Feature</th>
<th>Hyperarticulation</th>
<th>Hypoarticulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stress/Accent</td>
<td>Stressed/Accented</td>
<td>Unstressed/Unaccented</td>
</tr>
<tr>
<td>Prosodic boundary</td>
<td>Domain-initial</td>
<td>Domain-medial</td>
</tr>
<tr>
<td>Word frequency</td>
<td>Low frequency</td>
<td>High frequency</td>
</tr>
<tr>
<td>Semantic predictability</td>
<td>Unpredictable</td>
<td>Predictable</td>
</tr>
<tr>
<td>Speech style</td>
<td>Careful/Formal</td>
<td>Casual</td>
</tr>
<tr>
<td>Speech material</td>
<td>Word list</td>
<td>Reading passage</td>
</tr>
</tbody>
</table>
Other types of hypo-hyperarticulation continuum and chain shift

• Speech style
  – Formal vs. casual
    • Chambers and Hall 2014: hyperarticulation toward *change* (Canadian shift)
  – Word list vs. reading passage
    • Hall 2014: hyperarticulation to *periphery* (Canadian shift)
    • Hall-Lew, et al. 2015: hyperarticulation toward *change* (California shift)
  – Clear vs. casual speech
    • Leung et al. 2015: hyperarticulation toward *periphery* (u-fronting, Western Canada)
Other types of hypo-hyperarticulation continuum and chain shift

• Lexical frequency
  – Hay et al. 2015 (New Zealand shift)
    • *Low frequency words are more advanced in change*
    • hyperarticulation toward *change* (Not author’s interpretation)
  – Dinkin 2008 (Northern Cities Shift)
    • *Low frequency words are more peripheral*
    • hyperarticulation toward *periphery*

• Semantic predictability
  – Clopper and Pierrehumbert 2008 (Northern Cities Shift)
    • high predictability words are more advanced in change
    • *hypo*articulation toward change
Interim summary

• Not enough research on the interaction of prosodic prominence and chain shift.
• What’s available is inconsistent... But, maybe this is as expected?
Hypothesis

• For sounds undergoing change, two types of pressures are at play:
  – Duration-conditioned variation: physiological and universal
    • Hyperarticulation to periphery (=Hypoarticulation to centre)
  – Prosodically-conditioned variation: may have physiological origin but grammaticalized
    • Hyperarticulation toward change (=Hypoarticulation to centre)

• To see the effect of the latter, the first should be controlled.
Prosodic prominence in Seoul Korean

• Korean does not have “stress” in the sense of English.
• Rather, boundaries of prosodic domain is the locus of prosodic prominence (Cho and Keating, 2001).
  – Longer duration, stronger articulation
• Also, phonologically, word-initial position is a position of prominence (Kang, 2014).
  – retaining more contrasts and acting as a trigger of phonological processes.
Seoul Korean vowels

<table>
<thead>
<tr>
<th>ɨ</th>
<th>ɨ́</th>
<th>ʊ</th>
</tr>
</thead>
<tbody>
<tr>
<td>ɛ</td>
<td>ʌ</td>
<td>ɑ</td>
</tr>
<tr>
<td>o</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The Reading-Style Speech Corpus of Standard Korean

- The National Institute of the Korean Language (2002)
- 60 male, 60 female, Seoul-Kyeoungki area
- Age/Year of Birth distribution

<table>
<thead>
<tr>
<th>Year of Birth</th>
<th>1930s</th>
<th>1940s</th>
<th>1950s</th>
<th>1960s</th>
<th>1970s</th>
<th>1980s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>4</td>
<td>12</td>
<td>4</td>
<td>8</td>
<td>27 (26)</td>
<td>5</td>
</tr>
<tr>
<td>Female</td>
<td>2</td>
<td>10 (9)</td>
<td>25</td>
<td>3</td>
<td>11</td>
<td>9</td>
</tr>
</tbody>
</table>

- A total of > 1 million monophthongal vowel tokens
Exclusions

- Functional words or morphemes
- Phrase/word-final syllables
- Phonemic long vowels (only found in 1st syllable)
- Formant outliers (>2.5 SD for speaker)
- Super long vowels (>200ms): likely an alignment error
- File errors

- n=587,516
Acoustic analysis

- Vowels were automatically located using a custom-made automatic phone-aligner (Yoon and Kang 2012)
- Formants were measured using a gender and vowel-specific formant ceiling settings to minimize formant tracking errors (Kang 2014, Yoon and Kang 2015).
- Average of formant measurements from mid 20% of vowel duration
- Labov normalization (Kendall 2014)
Statistical analyses

• Separate F1 and F2 models for each vowel
• Dependent variable: F1, F2 (normalized)
• Predictor variables
  – Year of birth (YOB)
  – Duration
  – Position (initial syllable vs. medial syllable)
• Control variables
  – Gender
  – Preceding C place, Following C place
• Random effects
  – Speaker: intercept, *position, *duration
  – Lexical item
Year of Birth Effect
Year of Birth effect prediction plot

- YOB 1933
- YOB 1983
Year of Birth effect prediction plot

Year of Birth (YOB) 1933, 1983

Graph showing the effect of year of birth on some metric (f1 vs. f2) with data points for two different years.
Year of Birth effect prediction plot

Vertical compression in South Korean dialects (Kwak 2003, Kang et al. 2014)
Duration-induced hypo-hyperarticulation
Duration effect prediction plot

- duration: 50ms
- duration: 150ms
Height: All vowels lower when longer (except /i/)
Front-Back: Front vowels are fronter and back vowels are more back when longer.
Duration-based hyperarticulation is not toward the target of change.
Position-induced hypo-hyperarticulation
Height: In the initial position, low vowels are lower and high vowels are higher.
/o/ patterns like a high vowel: substantial raising toward the direction of change. (up)
Front-Back: In the initial position, front vowels are more front and back vowel are more back.
/u/ is expected to be pulled back by this general pattern of hyperarticulation toward periphery in initial position. But, it is not...

Presumably due to pull toward the direction of change (front).
/i/ patterns like a front vowel and is hyperarticulated toward front in initial position, toward the direction of change (front).
Direction of hyperarticulation in initial position

<table>
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<th>Toward the direction of change</th>
<th>Toward periphery</th>
<th>Actual position effect</th>
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<tr>
<td>/o/</td>
<td>Raised</td>
<td>Raised</td>
<td>More raised!</td>
</tr>
<tr>
<td>/u/</td>
<td>Fronted</td>
<td>Retracted</td>
<td>No effect</td>
</tr>
<tr>
<td>/i/</td>
<td>Fronted</td>
<td>Stable</td>
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Summary

• We identified a pattern of positional effect on vowel quality, independent of duration-based variation.
  – Duration-based quality difference is due to articulatory undershoot (vowel raising and centralizing in short vowels).
  – Position-based quality difference is speaker-controlled: vowels in prominent position is hyperarticulated toward periphery + toward the direction of change.
Conclusion

• The back vowel shift in progress in Seoul Korean interacts with prosodic prominence.
  – Hyperarticulation toward the change.
  – Prominent position leads the change.

• Identifying this effect in data requires factoring out the effect of phonetic duration in the context of the vowel system in general.

• A casual form/more reduced speech style may not always be the best place to see the effect of on-going change.
Future questions

• How general is this finding?
• Is this true of all types of chain shift?
• How is this effect modulated by the dynamicity of the change?
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