Cross-language perception under sound change in progress: loanword connection

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Korean laryngeal contrast: stops

- Lenis: /p t k/
- Aspirated: /pʰ tʰ kʰ/
- Fortis: /p’ t’ k’/ (/pp tt kk/)

- təɾ-ə ‘to take out’
- tʰəɾ-ə ‘to shake off’
- t’əɾ-ə ‘to shiver’
Loanwords: English word-initial stops

• Voiceless $\rightarrow$ Aspirated

  $pan \rightarrow p^{h\varepsilon n}$
  $tan \rightarrow t^{h\varepsilon n}$
  $can \rightarrow k^{h\varepsilon n}$

• Voiced $\rightarrow$ Lenis ~ Fortis

  $bell \rightarrow pel$  $bonus \rightarrow p’onəs’ɨ$
  $disk \rightarrow tisikʰɨ$  $dollar \rightarrow t’alla$
  $guide \rightarrow kaiti$  $gas \rightarrow k’as’ɨ$
Diachrony of English voiced stop adaptation

(Kang 2008, 2010)
Acoustics

• **Voice Onset Time (VOT):**
  – correlate of voicing/aspiration

• **Fundamental Frequency (F0):**
  – correlate of pitch

• **H1-H2 (Spectral tilt):**
  – correlate of voice quality (breathiness, creakiness)

Comparison of Korean stops with English voiced stop

- aspirated(K)
- lenis(K)
- fortis(K)
- voiced(E)
Comparison of Korean stops with English voiced stop

VOT: Ambiguous  F0: Lenis = Voiced  H1-H2: Fortis = Voiced
VOT merger in Seoul Korean

Figure 1

From Silva (2006)

Questions

• Q1: Is the change in loanword due to change in perception?

• Q2: If so, how do older and younger Koreans differ in their perception?
  – Is the difference related to the sound change in Korean?
Participants

• 57 Seoul Korean speakers/listeners
  – **SO** (Older): 32 (YOB: 1943~1966), 17M & 15F
  – Data collected in Seoul
Perception Stimuli

• English word-initial stops in nonsense words
  – Voiced stops (gáhra, ghéera, grah)
    • 3 words*3 speakers*6 tokens= 54
  – Voiceless stops (káhra, kéera, krah) as control
    • 3 words*3 speakers*1 token=9
  ⇒ 63 words

• Speakers
  – 3 male speakers of English, Southern Ontario
Perception study
Production

• Material
  təl-ə ‘to take out’
  tʰəl-i ‘hair-nom.’
  t’əl-ə ‘to shiver’
  – in isolation
  – 3 repetitions
Perception of English stops

Voiced

Voiceless

lenis
fortis
aspirated
Perception of English voiced stops

Older

Younger

- lenis
- fortis
- aspirated
Lenis perception rate by year of birth

Spearman's rho = 0.7116
p < 0.0001
Interim summary

• Older and Younger listeners’ perception mirrors the change in loanword pattern.
• Supports the view that the diachronic change in loanword pattern has a perceptual basis.
• How is the generational difference in perception related to their difference in native production?
Mixed effects model comparisons

- Dependent variable: k vs. kk
- Fixed effects: scale(f0), scale(h1h2), scale(vot)
- Random effect: subject, fully crossed
- Separate models for SO and SY
- Comparison of full model vs. model with two of the fixed effects
  - SO: Only h1h2 and vot are significant.
    - $h1h2 \chi^2(5)=23.045, p<0.001$
    - $vot \chi^2(5)=79.647, p<0.0001$
    - $f0 \chi^2(5)=1.6739, p=0.8922$
  - SY: All three are significant:
    - $h1h2 \chi^2(5)=13.108, p<0.05$
    - $vot \chi^2(5)=88.675, p<0.0001$
    - $f0 \chi^2(5)=34.807, p<0.0001$
Lenis perception rate: Younger listeners

Lenis perception rate: Older listeners

- Above 90%
- 50~90%
- 30~50%
- Below 30%
Lenis perception rate: Younger listeners

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Lenis perception rate: Older listeners

- Above 90%
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- 30~50%
- Below 30%
• Lenis perception below 50% is found only for stimuli that meet the following conditions:
  – Low H1-H2 (non-breathy voice)
  – Short-lag VOT (voiceless unaspirated)
  – Higher F0 (higher pitch on the following V)
• Elsewhere, Lenis perception is the majority.
SO

• Lenis perception below 30% is limited to tokens with:
  – Negative H1-H2 (Non-breathy voice)
  – Short lag VOT (voiceless unaspirated)

But,
  – May have high or low F0
F0

• Younger listeners show sensitivity to F0 but not older listeners.
• Due to VOT merger, F0 becomes “contrastive” in lenis vs. aspirated contrast, in younger speakers’ speech. (cf. “Tonogenesis” Silva 2006)
• Younger speakers/listeners may have become more sensitive to F0 in lenis vs. fortis contrast as well.

General “bias” toward lenis by younger listeners: Exposure to English

- Younger speakers have more exposure to English.
- They perceive English stimuli according to English category and map them to Korean category by analogy to the general pattern (=lenis).
- They choose fortis only when it is a very convincing exemplar.
- Plausible but not likely the whole story
  - We find similar preference (although less striking) for lenis perception by younger listeners even for Japanese voiced stops.
Task effect?

• Younger listeners are in general more “accurate” in showing sensitivity to cues in the right direction.

• They are likely more comfortable with a compute-mediated task.

• Plausible but not likely the whole story
  – Older listeners still show sensitivity to H1-H2 and VOT but not F0.
  – The asymmetry between these cues within the older listeners need to be explained regardless.
Summary

• Younger listeners show far less fortis responses than older groups.
• Younger speakers differ from SO speakers in their VOT realization of stops.
• Younger speakers are sensitive to F0 and VOT as well as H1-H2 cues while older listeners only show sensitivity to H1-H2 and VOT.
• These differences may be related to the sound change in Korean stops.
• General bias toward lenis stops by younger listeners may have additional explanations.
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