L2 Acquisition of Korean Stops by English and Chinese Learners

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• Introduction
• Production experiment
• Perception experiment
• Pedagogical implications
Korean has a 3-way distinction among voiceless stops (fortis, lenis, aspirated)

- \([p^*, p, p^h], [t^*, t, t^h], [k^*, k, k^h]\)

<table>
<thead>
<tr>
<th></th>
<th>bilabial</th>
<th>alveolar</th>
<th>velar</th>
</tr>
</thead>
<tbody>
<tr>
<td>/p^h/</td>
<td>필요하다 ‘to need’</td>
<td>/t^h/ 특히 ‘especially’</td>
<td>/k^h/ 크다 ‘to be big’</td>
</tr>
<tr>
<td>/p/</td>
<td>보다 ‘to see’</td>
<td>/t/ 더 ‘more’</td>
<td>/k/ 척 ‘thing’</td>
</tr>
<tr>
<td>/p^*/</td>
<td>빼다 ‘to pull out’</td>
<td>/t^*/ 그때 ‘then’</td>
<td>/k^*/ 끝 ‘end’</td>
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Traditionally the stops were distinguished on the basis of voice onset time (VOT).
Recent studies suggest that there is an on-going language change involving these stops (Kim, 2004; Silva, 2006; Kang & Guion, 2008; Kang, 2010)

- Contemporary Korean speakers use:
  - Pitch (F0) in addition to VOT

![Low pitched](image1.png)
![High pitched](image2.png)
• English and Mandarin Chinese
  ○ 2-way stop categories based on VOT (short vs. long VOT)
    ■ [b] vs. [p] in English
    ■ [p] vs. [p^h] in Mandarin Chinese

• Previous work - Production
  ○ L1-English learners used VOT and not F0 (Kim & Lotto, 2002)
  ○ L1-Chinese learners used VOT and F0 (Chang, 2009)
Remaining question - Do L2 learners use F0 as a cue in perception?

The present study:
1) Do English and Mandarin Chinese learners of Korean use F0 in production in discerning the Korean stops to the same extent as contemporary Korean speakers do?
2) Do the same learners use F0 in their perception of the stops?
Undergraduate students attending University of Oregon participated in both production and perception experiments.

- Native speakers of Korean (N=8; 4 females, 4 males)
- L1-ENG learners (N=7; 4 females, 3 males)
  - 4 in 1st year, 2 in 2nd year, 1 in 3rd year
- L1-CHN learners (N=6; 3 females, 3 males)
  - 5 in 1st year, 1 in 2nd year

L1-English and L1-Chinese students make up a large portion of L2 Korean learners in many U.S. schools.
PRODUCTION EXPERIMENT: METHOD

- Test words
  - 9 /Can/ and 9 /Cuk/ words
    - $C = /p, p^h, p^*, t, t^h, t^*, k, k^h, k^*/$
    - In a carrier sentence: 그래서 <___> 이라 했다
      - [ɡɯɾɛsʰʌ <___>ɪɾa hɛtta] ‘somebody said <___>’
- Stimulus sentences appeared on a computer screen in 5 random order (E-prime)
- Speakers were asked to read the sentences aloud, while being recorded individually in a sound booth
● Speech data:
  ○ 18 words x 5 repetitions x 21 participants = 1890 tokens

● Acoustic measurements:
  ○ VOT and F0, taken in each token
  ○ F0: at the ¼ point of the vowel
PRODUCTION EXPERIMENT: RESULTS

VOT (ms)
PRODUCTION EXPERIMENT: RESULTS

VOT (ms)

- **KOR**
  - Aspirated
  - Lenis
  - Fortis

- **L1-ENG**
  - Aspirated
  - Lenis
  - Fortis

Statistical significance:
- *: Significant difference
- ns: Non-significant difference
PRODUCTION EXPERIMENT: RESULTS

VOT (ms)

- **KOR**: 
  - Aspirated: 
  - Lenis: 
  - Fortis: 

- **L1-ENG**: 
  - Aspirated: 
  - Lenis: 
  - Fortis: 

- **L1-MND**: 
  - Aspirated: 
  - Lenis: 
  - Fortis: 

Note: * indicates statistical significance, ns indicates nonsignificance.
PRODUCTION EXPERIMENT: RESULTS

VOT (ms)

F0 (Hz)

KOR  L1-ENG  L1-MND

Korean

ns  *  ns  *

aspirated  lenis  fortis
PRODUCTION EXPERIMENT: RESULTS

**VOT (ms)**

- KOR
- L1-ENG
- L1-MND

**F0 (Hz)**

- Korean
- L1-ENG

Legend:
- aspirated
- lenis
- fortis

Statistical significance:
- * indicates significance
- ns indicates no significant difference
PRODUCTION EXPERIMENT: RESULTS

VOT (ms)

- KOR
- L1-ENG
- L1-MND

F0 (Hz)

- Korean
- L1-ENG
- L1-MND

Legend:
- aspirated
- lenis
- fortis

Significance:
- * significant difference
- ns non-significant difference
### Production Experiment: Results

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<td></td>
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Perception experiment tested how listeners use VOT and F0 in categorizing fortis, lenis and aspirated stops

Stimuli:
- Base tokens:
  - /pan/, /pʰan/, /tan/, /tʰan/, /kan/, /kʰan/
  - Spoken by 1 Korean male and 1 Korean female
- Manipulation
  - 5 VOT steps: 10 ms, 30 ms, 50 ms, 70 ms, 90 ms
  - 5 F0 steps: 190 Hz - 290 Hz (F), 95 Hz - 155 Hz (M)
PERCEPTION EXPERIMENT: METHOD

- **Stimuli**
  - 2 speakers (M, F) x 5 VOT x 5 F0 = 50 unique stimuli
  - Presented in 5 random order (E-Prime)

- **Task**
  - Participants heard each stimulus and responded whether the word was (in Hankul):
    - 반 /pan/, 판 /pʰan/, 빠 /pʰan/
    - 단 /tan/, 단 /tʰan/, 단 /tʰan/
    - 간 /kan/, 간 /kʰan/, 간 /kʰan/
The pattern was not continuous from 10ms of VOT to the rest of VOT values.

10ms of VOT was perceived primarily as fortis stops by native listeners and L1-CHN listeners.

This tendency was not observed in L1-ENG listeners.
2) Aspirated vs. Lenis - Aspirated
2) Aspirated vs. Lenis - Aspirated
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Aspirated Response by NS

Aspirated Response by L1-ENG

Aspirated Response by L1-MND
2) Aspirated vs. Lenis - Lenis

Lenis Response by NS
2) Aspirated vs. Lenis - Lenis

![Graph showing Lenis Response by NS and L1-ENG](image-url)
2) Aspirated vs. Lenis - Lenis

PERCEPTION EXPERIMENT: RESULTS

Lenis Response by NS

Lenis Response by L1-ENG

Lenis Response by L1-MND
**PRELIMINARY FINDINGS**

- **Korean NS** heavily rely on F0 in addition to VOT in discerning the three Korean stop categories in both production and perception.

- **L1-ENG learners**
  - Production: rely on VOT to the three-way stop distinction
  - Perception: seem to be influenced by both VOT and F0 in perception, particularly in aspirated and lenis categorization

- **L1-CHN learners**
  - Production: show the approximation of aspirated and lenis on the VOT dimension
  - Perception: successful in identifying fortis category; primarily use F0 to distinguish aspirated and lenis, but the distinction is not very robust
1) Providing phonetic instruction of using pitch (F0) to make the stop distinction

- There seems to be insufficient treatment of pronunciation, without any attention paid to pitch, in Korean language textbooks used in the U.S. (e.g. Integrated Korean Beginning 1)

- Visual input to enhance the learning process
  - Using hand gestures to indicate pitch level
2) Helping to develop learning strategies that are unique to each individual learner based on his/her L1

- L1-English and L1-Chinese students make up a large portion of L2 Korean learners in many U.S. schools. However, most textbooks used in the U.S. are mainly designed for L1-English learners, but not L1-Chinese learners
- Learners from different language backgrounds are likely to experience different challenges in acquiring Korean pronunciation
  - e.g. L1-English learners are less successful in using pitch as a cue in their production/perception compared to L1-Chinese learners
2) Helping to develop learning strategies that are unique to each individual learner based on his/her L1

- Using phonetic similarities between L1 and Korean
  - e.g. the fourth tone in Mandarin Chinese is said forcefully and abruptly (e.g. 爸爸 bàba) → forceful articulation for fortis stops in Korean

- Offering workshops to give learners the opportunity to do focused practice on pronunciation on a regular basis
  - Teachers can provide more corrective feedback on each learner’s specific pronunciation problems


