

# English Unaspirated Stops in the Consonant Clusters /s + p t k/ Produced by Native Korean Speakers: An Acoustic Analysis of Voice Onset Time

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## 1. Introduction

One might argue that, English stops such as /p t k/ are not that easy for native Korean speakers since there is a subtle distinction among the allophones in English (i.e., aspirated, unaspirated, and unreleased stops), which is not found in Korean. This is well supported by the fact that Korean speakers have difficulty clearly articulating the unaspirated stops in English consonant clusters /s + p t k/, because English voiceless stops /p t k/ are all regarded as /p<sup>h</sup> t<sup>h</sup> k<sup>h</sup>/ in Korean as is seen from a loanword from English *open* [op<sup>h</sup>ɛn] (Park, 2007). Therefore, it is readily predicted that native Korean speakers tend not to distinguish between English aspirated stops in word-initial position and unaspirated stops in /s + p t k/ clusters, if they are asked to read such words written even in English. Due to the discrepancy in the phonemic systems of both languages, they hardly show a native-like production, although there is no meaning difference or misunderstanding.

This study examines how well native Korean speakers produce unaspirated stops in English /s + p t k/ clusters based on their English proficiency levels and how much their production of the stops in the clusters is affected by the phonemic system of their native language with the aid of an acoustic analysis of voice onset time (henceforth VOT).

## 2. Previous Studies and The Focus of The Present Study

### 2.1. Previous study

In this part, some previous studies regarding stop categories in English and Korean are introduced as the background on the subject matter of the present study. The main topics of the previous studies are as follows: how stops are classified differently in the English and Korean languages, and how such difference affects the production of English stops when borrowed into the Korean language.

Lisker and Abramson (1964) argued that English and Korean belong to two-category languages and three-category languages, respectively. Their classification is based on voice onset time. In English, there is a voiced-voiceless distinction, and VOT distribution showed values of around zero for /b d/ and positive values for /p t/. VOT distribution also functioned to explain three-category languages such as Korean in that all of them were placed over zero.

In this respect, the present study investigates how stops in the word-initial position and in /s + p t k/ clusters are differently produced by native speakers of English and Korean by analyzing VOTs in each stop. Furthermore, if there is a tendency for Korean speakers to pronounce the stops in /s + p t k/ as aspirated, the reason will be studied in terms of the effect of Korean phonemic system. Since consonant clusters are not allowed in Korean phonotactics, English sT-clusters<sup>1)</sup> become aspirated when borrowed into Korean according to An (2008). For example, the unaspirated velar stop immediately following /s/ in the English word *skate* [skeIt] is treated as an aspirated stop as is seen from [sÈk<sup>h</sup>Eit<sup>h</sup>È]. This study also took VOT as a means to categorize each kind of stops, since it serves well to distinguish aspirated stops from fortis stops. In general, the VOT values for the latter are shorter than those of aspirated stops.

When it comes to perception of unaspirated stops, An's hypothesis was that

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1) A sT-cluster stands for the consonant cluster made up of /s/ and a subsequent voiceless stop, that is, /s + p t k/.

they do hear unaspirated stops in /s + p t k/ clusters as unaspirated, and she proved it true through an experiment with native Korean speakers. However, it still seems strange that native Korean speakers pronounce stops in sT-clusters as aspirated even though it is argued that they correctly perceive them as unaspirated stops. An's solution to this problem is that Korean orthography requires all the voiceless stops in English be written as aspirated when loaned into Korean.

Based on this conclusion, the present study attempts to test the actual relation between Korean and English pronunciation produced by native speakers of Korean. That is to say, it seeks to find out whether Korean phonetic system in fact has an effect on Korean speakers' performance on English stops.

## 2.2. *The focus of the present study*

The present study sets out to investigate whether and how much Korean phonemic system plays a role when it comes to producing stops in /s + p t k/ clusters by Korean speakers. Accordingly, my research questions are as follows:

**Research question 1.** Is there any difference in the production of the English stops in /s + p t k/ clusters between native speakers of English and Korean?

**Research question 2.** If *yes*, does Korean phonemic system, which requires all English voiceless stops to be pronounced as aspirated when borrowed into Korean, have an impact on the production of the English stops in /s + p t k/ clusters by Korean speakers?

My hypotheses with regard to the research questions are as follows:

**Hypothesis 1.** There will be a difference in pronouncing the stops in /s + p t k/ clusters between native speakers of English and Korean. While native English speakers will produce them as unaspirated, overall native Korean speakers will produce them as aspirated.

**Hypothesis 2.** There will be an effect of Korean phonemic system. The requirement to pronounce all English voiceless stops borrowed into Ko-

rean as aspirated will cause Korean speakers not to distinguish /p/ in *pen* from that in *spin* both written in Korean, and this will lead to the same phenomenon when they read the corresponding words written even in English. However, the extent to which the effect of Korean system holds will vary depending on English proficiency level; the higher one's level is, less effect of Korean will be found and more native-like pronunciation will be accompanied instead.

In order to answer the research questions and verify the hypotheses, a production experiment was conducted following the details to be discussed in the next part.

### 3. Method

#### 3.1. Participants

Subjects were 2 native speakers of Canadian English (1 male speaker and 1 female speaker) and 6 native speakers of Korean (4 male speakers and 2 female speakers) ranging from 20 to 51. They were all undergraduate and graduate students at Seoul National University in Korea except the male Canadian English speaker who is an instructor at Language Education Institute in SNU. The Korean subjects were once again divided into three groups according to their TEPS<sup>2)</sup> scores: low-level proficiency (LP) group (0-500, two students), intermediate-level proficiency (IP) group (501-800, two students), and high-level proficiency (HP) group (801-990, two students).<sup>3)</sup> They were all controlled under the same condition in that none of them has ever stayed in any English speaking countries. It was verified by their responses to the questionnaire that they were asked to fill out (See appendix A). Table 1 shows the individual background of each Korean subjects. LPS, IPS, and HPS stand for low-level proficiency speakers, intermediate-level proficiency speakers, and high-level proficiency speakers, respectively.

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2) Test of English Proficiency developed by Seoul National University

3) The classification of three proficiency levels is based on <http://www.teps.or.kr/>.

**Table 1.** The individual background of each Korean subject

	LPS1	LPS2	IPS1	IPS2	HPS1	HPS2
Major	Science Education	Law	Nursing Science	Nursing Science	English Literature	English Literature
Course	Undergraduate	Graduate	Undergraduate	Undergraduate	Graduate	Undergraduate
Sex	Male	Male	Female	Female	Male	Male
TEPS	423	494	660	600	810	858

### 3.2. Stimuli

Two kinds of stimuli were used in this experiment: one written in English with 21 words and the other in Korean with the same number of words. They were created based on the classification of stops shown in Tables 2 and 3 below. However, the stimuli which were given to the subjects were different from what are seen from Tables 2 and 3, and instead the order was scrambled in an attempt to prevent the subjects from recognizing what was being targeted (See appendices B and C for the stimuli that subjects were asked to read).

The stimuli written in English were given to both native speakers of English and Korean.

As is seen from Table 3, the stimuli written in Korean were the Korean

**Table 2.** Stimuli written in English

	bilabial	alveolar	velar
aspirated stops	pill, pen, pool	till, ten, tool	kill, Ken, cool
unaspirated stops	speaker, spun, spool, spa	steel, stun, spool, star	ski, skunk, school, scar

**Table 3.** Stimuli written in Korean

bilabial	alveola	velar
필/pil/, 펜/pEn/, 풀/pul/	틸/til/, 텐/tEn/, 툴/tul/	킬/ki/, 켄/kEn/, 쿨/kul/
스피커/sËpIk@/, 스피너/sËpVn/, 스피클/sËpul/, 스파/sËpA/	스틸/sËtIl/, 스텐/sËtVn/, 스피클/sËpul/, 스타/sËtA/	스키/sËki/, 스킵/sËki/, 스쿨/sËkul/, 스카/sËkA/

transcribed version of the stimuli written in English, and they were given only to native speakers of Korean. Unlike Table 2, the leftmost column which had classified the stops as either aspirated or unaspirated was removed, since it was assumed that all English voiceless stops are transcribed as aspirated stops in Korean.

### 3.3. Procedure

Each subject was asked to read one set of stimuli composed of 21 words in a natural tone and speed for five times. They read each word embedded in carrier sentences: “*I’ll say \_\_\_.*” for the English stimuli and *like \_\_\_ ipnidal* “This is \_\_\_.” for the Korean stimuli. They were used in order not to make the subjects focus on the target sounds. Each of the Canadian English speakers read the stimuli only written in English for five times, resulting in reading 105 words in total (21 words in each set x five times). On the other hand, each native Korean speaker performed not only the English stimuli but also the Korean stimuli, resulting in reading 210 words in total (105 words in English and another 105 words in Korean). They were required to read English stimuli first and subsequently Korean ones in order to avoid the contrast effect which urges the subjects to perform more careful and exaggerated readings if they had performed in English after in Korean. What the subject read was recorded by the Zoom H4 Handy Digital Recorder in silent rooms.

### 3.4. Measurement

The recordings were analyzed acoustically by Praat downloaded from [www.praat.org](http://www.praat.org). With the help of Praat, the VOT values of each stop in 1,470 words in total (105 words x 2 Canadian English speakers and 210 words x 6 Korean speakers) were measured.

## 4. Results

Figure 1 shows the VOTs of the English voiceless stops in each word produced by English speakers and Korean speakers who belonging to the three proficiency groups.

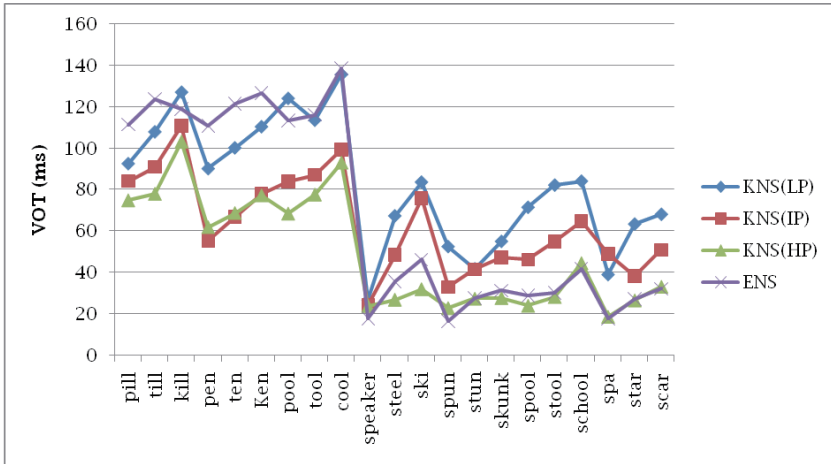


Figure 1. The VOTs of the stops in the word-initial position and in /s + p t k/ clusters produced by English speakers and Korean speakers.

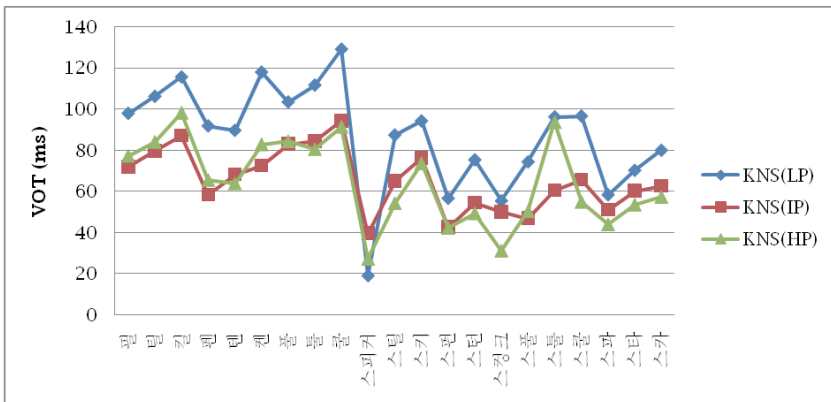


Figure 2. The VOTs of the stops in the Korean transcribed version of English words produced by Korean speakers.

As for the stops in the first nine words, that is, stops in the word-initial position (from *pill* to *cool*), native English speakers present the longest VOTs. On the other hand, with regard to the stops in the rest, that is, stops in /s + p t k/ clusters (from *speaker* to *scar*), English speakers show the shortest VOTs mostly. Furthermore, in the cases of the stops in /s + p t k/, the distribution of

Korean speakers partly supports my second hypothesis in that the VOT values of HP speakers are closest to those of native English speakers while those of IP are farther and those of LP are the farthest. However, with regard to the word-initial stops, it has been proved to be false.

It is now reasonable to elicit overall Korean speakers' production of the stops in Korean words borrowed from English as is seen from Figure 2. As was expected, in reading Korean stimuli, there is no tremendous difference among the VOTs of the stops in each word.

## 5. Conclusion

The present study has been motivated by the fact that English and Korean differ from each other in terms of stop categories. To be more specific, English has aspirated and unaspirated allophones under each phoneme of the voiceless stops /p t k/ while the distinction between aspirated and unaspirated stops is the matter of totally different phonemes in Korean. This might make native speakers of Korean be confused when producing English stops.

The first research question as to whether there is a difference in the production of English voiceless stops in /s + p t k/ clusters between native speakers of English and Korean has been answered as *yes*. The VOT values of overall native Korean speakers tend to be higher than those of native English speakers. The reason pertains to the second research question as to whether Korean phonemic system affected their production. It also proved to be true since when the Korean subjects were required to read the stimuli written in Korean orthography, they did show a difference among the VOTs of the voiceless stops. Furthermore, it appears that the lower a Korean speaker's English proficiency level is, the more effects from the Korean language he or she tends to be susceptible to on the ground that the HP group showed large differences in relatively more cases than the other groups did when reading the stimuli written in English.



## References

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**Appendix A: The questionnaire for the Korean subjects (translated into English here)**

1. Major: \_\_\_\_\_ , Course: \_\_\_\_\_
2. Age: \_\_\_\_\_
3. Sex: 1) Male 2) Female
4. TEPS score: \_\_\_\_\_
5. How many years have you studied English? \_\_\_\_\_
6. Have you ever stayed in any English speaking countries? 1) Yes 2) No
7. If yes, in which country? \_\_\_\_\_
8. If yes, at what age? \_\_\_\_\_
9. If yes, how long? \_\_\_\_\_

**Appendix B: Stimuli written in English for both native speakers of Canadian English and Korean**

I'll say \_\_\_\_\_.

- |            |           |           |
|------------|-----------|-----------|
| 1. scar    | 8. cool   | 15. spool |
| 2. spun    | 9. pill   | 16. Ken   |
| 3. tool    | 10. steel | 17. star  |
| 4. stool   | 11. spa   | 18. pool  |
| 5. speaker | 12. till  | 19. ski   |
| 6. school  | 13. skunk | 20. kill  |
| 7. pen     | 14. ten   | 21. stun  |

**Appendix C: Stimuli written in Korean only for native speakers of Korean**

이게 \_\_\_\_\_ 입니다.

- |        |         |        |
|--------|---------|--------|
| 1. 스카  | 8. 쿨    | 15. 스폴 |
| 2. 스피  | 9. 필    | 16. 켄  |
| 3. 툴   | 10. 스틸  | 17. 스타 |
| 4. 스톨  | 11. 스파  | 18. 폴  |
| 5. 스피커 | 12. 킬   | 19. 스키 |
| 6. 스클  | 13. 스킵크 | 20. 킬  |
| 7. 펜   | 14. 텐   | 21. 스티 |

## ABSTRACT

English Unaspirated Stops in the  
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Produced by Native Korean Speakers:  
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The present study investigates native Korean speakers' production of English unaspirated stops in the consonant clusters /s + p t k/. It is notable that the phonemic systems in English and Korean are different from each other; that is, while English is a two-category language of which voiceless stops have aspirated and unaspirated allophones, the distinction depending on aspiration is not found in English words borrowed into Korean. Instead, English unaspirated stops as well as aspirated stops are adopted as aspirated stops in Korean. Therefore, it is hypothesized, in this paper, that native speakers of Korean tend to be influenced by their native language when producing English unaspirated stops. A production experiment was conducted in order to compare the voice onset time values of each stop produced by native speakers of English and Korean. The results show that the values of native Korean speakers are higher than those of native English speakers, which means that Korean speakers produce stops in the consonant clusters /s + p t k/ as if they were aspirated stops. It also turned out that the English proficiency level of native Korean speakers have an effect on the voice onset time values.

*Key Words* English unaspirated stops, consonant clusters, native Korean speakers, voice onset time (VOT)