Perception of English palatal codas by Korean speakers of English

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This study aimed at examining perception of English palatal codas (e.g., fish, change, catch) by Korean speakers of English to determine if perception problems are the source of production problems. In particular, this study first looked at possible first language effects on the perception of English palatal codas, and second at a possible perceptual source of vowel insertion after English palatal codas. In addition, individual factors, such as length of residence, TOEFL score, gender and academic status, were compared to determine if those affected the varying degree of the perception accuracy. Eleven adult Korean speakers of English as well as 3 native speakers of English participated in the study. Three sets of a perception test including identification of minimally different pseudo- or real English words were administered (e.g., fish vs. fishy). The results showed that, first, the Korean speakers perceived the English palatal codas significantly worse than the Americans. Second, the study supported the idea that Koreans perceived an extra [i] after the final affricates (e.g., catch as catchy) due to the release. Finally, none of the individual factors explained the varying degree of the perceptual accuracy. In particular, TOEFL scores and the perception test scores did not have any statistically significant association.

1. Introduction

It is widely accepted that even after years of exposure to the second language (L2), adult L2 learners continue to produce the L2 with varying degrees of foreign accent. Foreign accents are also difficult to eradicate. Even those exposed to the L2 for long periods of time are likely to retain phonological properties of their first language (L1) in their L2 perception and production. Some researchers argue that perception and production problems are related, and perception problems might be the source of production problems, even though perception problems are not as apparent as production problems (e.g., Flege et al., 1995b), and others argue that production problems are just articulatory problems (e.g., Schmidt & Meyer, 1995).

The present study constitutes the preliminary research on the relation between perception and production of English sounds of Korean speakers, especially the coda segments, [ʃ], [tʃ] and [dʒ], which are all palatal sounds. Those segments are illicit in coda position in Korean. It is said that Koreans typically produce an additional [i] after final palatal sounds of English words (Schmidt & Meyer, 1995). If this non-target-like production is found to reflect problems of perception, it is of importance to find and correct the source. Since there is a paucity of perception studies on those segments by L2 learners, my focus here is to see if there is difference in the perception of those segments between Korean speakers of English and native speakers of English, and subsequently determine what causes the problem. Additionally, different individual factors, such as TOEFL score, which might affect the degree of perception accuracy, will be discussed.

1.1 Foreign accent and relation between production and perception

Insertion of [i] after English palatal codas is one of the common features of foreign accent produced by Korean speakers. Foreign accent is inevitable if a L2 learner learns the L2 after the critical period (Lennenberg, 1967), or sensitive period (Lamendella, 1977). Recently, several researchers have provided evidence that attempts to refute these hypotheses (e.g., Birdsong, 1999; Bongaerts et al., 1997; Dekeyser, 2000). Their claim is that there are several exceptional L2 learners who reach native-like proficiency even though they are first exposed to the L2 after puberty. Bongaerts et al. (1997) reported that the learners who reached native-like proficiency took explicit perception training and recognized the importance of pronunciation training.

Since the communicative teaching approach has become popular, explicit pronunciation teaching has been avoided in the classroom, due to favoring of fluency over accuracy. However, many communication problems result from L2 pronunciation errors, i.e., foreign accent (e.g., Fayer & Kraninski, 1987; Morley, 1991). Some suggest that pronunciation is the most common complaint from students of international teaching assistants (Morley, 1991), and it can cause distractions as well (Fayer & Kraninski, 1987). The need for teaching pronunciation is obvious, as many second language teachers wonder why there are the varying degrees of foreign accent.

Among the possible sources influencing the varying degrees of foreign accent, age of arrival (AOA) has been well studied. Age of arrival is defined as the age of arrival to a predominantly L2 speaking community (Piske et al., 2001). The general agreement is that “the younger the better,” but the effect is still inconclusive. Flege et al. (1995a), for example, examined the production of English consonants by
bilinguals and found that early bilinguals did not show any significant differences from native speakers of English, but late bilinguals did. On the other hand, Neufeld (1979) provided evidence that adult L2 learners could achieve native-like accuracy in L2 pronunciation.

Length of residence (LOR) is also a well-studied factor, but the effect on L2 acquisition is inconclusive as well. For example, Oyama (1976) claimed that AOA could predict the degree of foreign accent, but LOR could not. Furthermore, Piske et al. (2001) found that LOR and foreign accent had a negative relationship in a simple correlation, but when AOA was partialled out, LOR did not show a significant correlation. Other studies found no significant correlation between LOR and foreign accent (e.g., Tahta et al., 1981). On the other hand, Riney and Flege (1998) reported that some Japanese students showed significant improvement in perception and production of English [r] and [l] during 4 years of college, where English input was abundant.

Gender is another possible factor that attributes to the varying degrees of L2 proficiency, but this factor does not seem to affect pronunciation accuracy significantly (e.g., Oyama, 1976). Rather, it is claimed to affect second language learning style, strategies, etc. (e.g., Zoubir-Shaw & Oxford, 1994). Yet, studies exist claiming that females have less heavy foreign accent than males do (e.g., Tahta et al., 1981).

Finally, L2 use has also been assumed to have a significant impact on foreign accent. In many studies (e.g., Flege et al., 1995a; Tahta et al., 1981), L2 use seems to have a significant association to the degree of foreign accent: the more L2 use, the closer to target-like pronunciation. For example, Flege et al. (1995a) claimed that language use at work, home or with friends was found to be the second major factor affecting pronunciation accuracy, although the amount of L2 use was different between males and females. Furthermore, Piske et al. (2001) pointed out that the more the L1 was used, the heavier the foreign accent. However, in other studies, L1/L2 use was determined to be an insignificant variable (e.g., Flege & Fletcher, 1992). Other factors, such as motivation, aptitude and formal education, are also inconclusive as factors affecting the varying degrees of foreign accent.

On top of the fact that there are several factors affecting foreign accent, it is unclear what causes it. One of the speculated reasons why late L2 learners cannot attain native-like pronunciation is due to problems of perception (e.g., Flege, 1995). Perception problems are claimed to originate from processing the L2 in terms of the L1 sound categories. Flege (1995) proposed a Speech Learning Model (SLM) and argued that the more an L2 segment is similar to that of an L1 segment, the harder it is for an L2 learner to acquire that segment. For example, Spanish speakers of English have difficulty distinguishing between English [ae] and [a], because [ae] is perceived similar to [a], and subsequently they produce [ae] and [a] the same. It is claimed that the discrepancy between the L1 and L2 decreases if an L2 phonetic category is deflected away from an L1 category (Flege, 1995).

Furthermore, several studies show that production problems arise when L1 and L2 segments are similar, which also implies that different or “new” segments are easier to produce. For example, Riney and Takagi (1999) stated that even though Japanese has voiceless stops, Japanese speakers of English did not produce native-like English voiceless stops: their Voice Onset Time (VOT) values of voiceless stops were different from those produced by native speakers of English. In addition, Flege and Hillenbrand (1987b) examined the production of French [u] and [y] vowels by native speakers of English and reported that they approximated French [u] to that of English. Their [u] was not produced phonetically identical to [u] of native speakers of French, whose second formant is significantly lower than English [u].

Others have investigated perceptual differences between L1 and L2 and suspected those as the causes of difficulties by L2 learners. Rochet (1995) examined the perception of French [y] by English and Portuguese speakers. English speakers perceived it as [u], whereas Portuguese speakers perceived it as [i]. The author suspected that the phonetic boundaries of these segments were different in all three languages, i.e., French [y] is closer to English [u] and Portuguese [i] in terms of F2 frequency. As for consonants, Flege and Hillenbrand (1987a) examined English final stop perception by English and French speakers. The authors varied the release burst and glottal pulsing of [g] in word final position and found that French speakers used the release burst more than English speakers did to distinguish [k] and [g]. The speculated reason was that the French uses the release burst exclusively to identify voiced/voiceless segments.

As for the relationship between perception and production in L2, they do not seem to be in a strong correlation, although some relation is arguably apparent. Providing evidence from L1 studies, Best (1995) claims that perception precedes production: the prerequisite for production is the perception of gestural or acoustic cues (Liberman & Mattingly, 1985; Diehl & Klunder, 1990). Flege et al. (1995b) also claim that accurate perception of an L2 segment is necessary for accurate production of the segment but not sufficient. Others claim that L2 production can precede L2 perception. For example, it is claimed that some Japanese
learners of English produce English [r] and [l] better than they perceive (Sheldon & Strange, 1982). Others suggest that there is no relationship between perception and production (e.g. Joh & Lee, 2001). Finally, a series of studies done by Bradlow et al. (1997, 1999) implied that the rate of improvements in production and perception of L2 segments is not linear. Typically improvements in perception precede improvements in production.

1.2. Differences between English and Korean obstruents

In order to understand the source of problems of Korean speakers of English, the sound systems of both languages should be discussed. Simply stated, Korean and English sound systems are vastly different. First, in terms of syllable structure, Korean allows syllables of the type (C)V(C), and in coda position, only voiceless stops, nasals and /l/ are allowed (Yoo, 1996). On the other hand, English permits all obstruents, except /h/, in coda position. In the loanword phonology of Korean, English stop codas become onset of the following syllable by epenthesizing [ut] (e.g., beat [bitut]). Palatal affricate and fricative codas become onset of the next syllable by epenthésising [i] (Yoo, 1996). This pattern of epenthesis is well studied in the acquisition of English by Korean speakers as well (e.g., Major & Faudree, 1996).

Second, in terms of place of articulation, Korean palatals are not exactly palatals. Kim (1999) argues that Korean affricates, [tʃʰ], [tʃ] and [tʃ'], are neither alveolo-palatal, nor palato-alveolar. Providing evidence from a phonological and acoustical perspective, she claims that Korean affricates are alveolar. Others also support the idea that Korean affricates are either denti-alveolar or alveolar (e.g., Schmidt & Meyer, 1995).

If we accept Kim’s argument, then Korean learners will have a hard time producing English palatals correctly. Ladefoged and Maddieson (1996) argued that English palatals are all alveolo-palatals and should be distinguished from palato-alveolar sounds, which are found in languages like Chinese. Since Korean palatals are actually alveolar (Kim, 1999; Schmidt & Meyer, 1995), and Korean speakers of English are likely to use them when producing English palatals, they might have a tendency to misarticulate English palatal sounds.

In conclusion, foreign accent is an obvious problem that most adult L2 speakers have, and there are some factors which might affect the varying degrees of foreign accent. In addition, previous studies have suggested that production and perception are intrinsically related, although the relation is unclear yet. Finally, due to critical differences between Korean and English, Korean learners of English are expected to have production problems. The question raised here is that if this problem in production originates from problems in perception.

2. Research questions and hypotheses

It has been said that Korean learners of English tend to produce [ʃ], [tʃ] and [dʒ] followed by [i] in word-final position (Schmidt & Meyer, 1995). Even though previous research suggests that Korean palatal sounds are different from those in English (Kim, 1999), none has provided empirical data on the perception of English palatals by Korean speakers of English. Therefore, there are three questions to be discussed. The first question is whether and how much Koreans perceive English palatal sounds differently from English speakers. The tasks used in the study contained palatal stimuli which did not require any meaning association. Therefore, the only difference between Korean speakers of English and native speakers of English is assumed to be their ability to identify the stimuli acoustically. It is expected that Korean speakers perceive English palatal codas worse than native English speakers due to the L1 effect. The second question is what triggers the epenthesis by Korean L2 speakers. To answer this question, first affricates were presented to the participants with two different types of release: a normal release and a release followed by [i]. If participants do worse in words with a normal release, then we can speculate the source of perception problems lies in the release of affricates. Second, different English fricatives, [ʃ], [s], [f] and [θ], were presented. The stimuli was composed of sets of words with fricative endings and with fricative+vowel endings. If participants perceive the difference in a stimuli set containing a certain fricative better than a stimuli set containing other fricatives, then we can speculate that the source of the perception problem lies in a certain range of noise in the fricatives. For example, if participants have a hard time differentiating words ending with [ʃ] and ending with [ʃi], but not with other fricative sets, then the noise range of [ʃ]
frication might trigger the misperception. Third, it is of interest what individual factors might contribute to the varying degrees of perception of English palatal sounds.

According to possible answers to the above questions, two hypotheses are to be discussed.

First, Korean speakers of English will do worse than native speakers of English in the perception of English palatal codas.

Second, Korean speakers of English will do worse in perceiving words ending with a palatal coda than words ending with a palatal+i.

3. Method

3.1. Participants

Eleven Koreans who are graduate students at the University of Florida (UF) and the English Language Institute (ELI) at UF participated in the study. Their length of residence and age of arrival varied; however, all of them came to the U.S. after puberty (age range: 22-34 years old). All of the participants finished six years of English education in Korea before coming to the U.S. and started to study English in middle school when they were 13 or 14 years old. There were 4 females and 7 males. The participants were asked to fill out a background questionnaire, which was composed of questions regarding personal information. The background information of each participant is attached in Appendix A. There was one group of American speakers of English, which served as a control group. Three native speakers of English who participated in the study were in the graduate school at the UF.

3.2. Stimuli

Three sets of stimuli were used. An American graduate student who spoke standard American English and took phonetic training pronounced all words in the perception tests. In all sets, [3] coda stimuli were excluded due to its paucity of minimal pairs. In set 1, words ending with an affricate were produced in two different manners: a normal release and a release followed by [i]. Words ending with fricatives were produced in two different manners, with/without vowel endings. All words were pseudo-English words. In set 2, a combination of real words and pseudo-English words was used. The stimuli were either pronounced correctly or not. For example, incorrectly pronounced *sash* was [saʃ]. First, the stimuli were produced correctly. Then the stimuli were produced with [i], if the real word ends with a consonant (C). If the real word ends with a consonant+i (Ci), the word pronounced correctly first and then without [i]. The same number of C and Ci stimuli was used. In set 3, all words were real English words. Stimuli were minimally different words, for example, *fish* and *fishy*. In this set, the participants were asked to decide between minimally different words ending with C or with Ci. The same number of C or Ci stimuli was used. The order of all words in each set was randomized. All sets began with 8 training stimuli. The word list used in all sets is attached in Appendix B, and table 1 shows the number of each stimulus used in the test.

<table>
<thead>
<tr>
<th>Table 1. Stimuli</th>
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<tbody>
<tr>
<td><strong>Set 1</strong></td>
</tr>
<tr>
<td>Fricatives--3 words * 4 types ([ʃ], [s], [f] and [θ]) * 2 (C/Cv) = 24</td>
</tr>
<tr>
<td>Affricates--3 words * 2 types ([tʃ, dʒ]) * 2 (C/Ci) = 12</td>
</tr>
<tr>
<td><strong>Set 2</strong></td>
</tr>
<tr>
<td>3 words * 3 types (tʃ, dʒ, j) * 2 (words/pseudo-words) * 2 (C, Ci) + 1 repetition of 6 stimuli = 42</td>
</tr>
<tr>
<td><strong>Set 3</strong></td>
</tr>
<tr>
<td>3 words * 3 types (tʃ, dʒ, j) * 2 (C/Ci) + 1 repetition of 6 stimuli = 24</td>
</tr>
</tbody>
</table>

3.3. Procedure

All participants reported no hearing problems. The test was conducted individually. The participants were in a quiet room and provided with a headset. All stimuli were presented on a computer screen. To familiarize the participants with the study, training trials (8 stimuli for each set) were provided. The entire test was written in English orthography. For set 1, the participants were told what they would hear was not
English, or Korean, and their task was to identify which one they heard. For set 2, the participants were told that the words they would hear might not be real English words and decide if the word they would hear was correctly pronounced or not. If they heard correct pronunciation, they would click "correct." If not, they would click "incorrect." For set 3, the participants were told to choose the correct English orthography based on what they heard. For all sets, minimally different word pairs were presented.

3.4. Data analysis

First, the number of correctly identified stimuli for each set was compared using an independent samples t-test: the independent variable was L1 (English vs. Korean). The total number of correctly identified stimuli across each set was also compared based on L1. In addition, the total number of correctly identified palatal endings and palatal+i endings was compared based on L1. Second, among Koreans, for each set and for total score across all sets, the number of correctly identified words based on coda type was compared using a paired samples t-test: C stimuli and Ci stimuli were dependent variables. Finally, among Koreans, to understand the effect of individual factors on perception, an independent samples t-test was performed: the independent variables were length of residence (less than 1 year vs. more than 1 year), gender (females vs. males), English proficiency (TOEFL score range below 560 vs. above 560) and academic status (graduate vs. ELI). The total number of correctly identified stimuli across the sets was a dependent variable. L2 use was excluded since only one person answered that he used the L2 more than fifty percent of his daily language use. Others reported that they used English less than fifty percent.

4. Results and discussion

For hypothesis 1, the test score was compared between the English control group (EC) and Korean speakers (NK) and is presented in Table 2. For each set, there was no significant difference between English and Korean speakers. In addition, among Koreans, there was a fairly large individual difference. However, when total score across three sets was calculated, there was significant difference between the American and Korean speakers ($p<0.05$): EC perceived affricates and fricatives significantly better than NK. When all non-palatal segments from set 1 were eliminated, the total score still showed significant difference ($t=2.202$, $p<0.05$): EC perceived palatals significantly better than NK. When total score across the sets in words with palatal endings and words with palatal+i was compared between NK and EC, there was significant difference in words with palatal endings ($t=2.771$, $p<0.05$), but no difference in words with palatal+i. This implies that Koreans perceive palatal codas worse than EC, but not palatal+i. Since the task did not require any linguistic information but only acoustic identification ability, the difference in the total score is explained as the difference in identification ability due to their first language background.

Table 2. Perception test score

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>$p$, t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC</td>
<td>35.7</td>
<td>0.58</td>
<td>0.085, 1.87</td>
</tr>
<tr>
<td>NK</td>
<td>29.9</td>
<td>5.15</td>
<td></td>
</tr>
<tr>
<td>Set 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC</td>
<td>41</td>
<td>0</td>
<td>0.14, 1.57</td>
</tr>
<tr>
<td>NK</td>
<td>31</td>
<td>10.7</td>
<td></td>
</tr>
<tr>
<td>Set 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC</td>
<td>23</td>
<td>0</td>
<td>0.2, 1.35</td>
</tr>
<tr>
<td>NK</td>
<td>20.7</td>
<td>2.83</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>99.6</td>
<td>0.57</td>
<td>0.025, 2.56</td>
</tr>
<tr>
<td></td>
<td>81.7</td>
<td>11.8</td>
<td></td>
</tr>
</tbody>
</table>

For hypothesis 2, among Koreans, correctly identified items between words ending with consonants (C) and with the consonant+vowel (Cv) in each set was compared. First, in set 1, there was no significant difference in the perception of word sets containing affricates, [tʃ], [dʒ], and in the perception of word sets containing fricatives, namely [s], [ʃ], [θ] and [ʃ]. Even when affricates and [ʃ] were combined, namely all palatal sounds, and compared between words with C and words with consonant+i (Ci), there was no difference. In set 2, first, the difference in perceptual correctness between real words and pseudo-words was not significant. Second, there was significant difference between words with C and with Ci endings ($t=-2.7$, $p=0.02$). The result is shown in Table 3. In set 3, there was no significant difference between words
with C and with Ci endings. Finally, when words with C and words with Ci (palatals only) were compared among NK across all sets, there was significant difference ($t=-3.844$, $p<0.003$): NK made more mistakes in perceiving words with palatal endings than words with palatal+i endings.

Table 3. Paired Samples Statistics: Set 2

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>$p$, $t$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Words with C</td>
<td>14.6364</td>
<td>4.6534</td>
<td>0.02, -2.7</td>
</tr>
<tr>
<td>Words with Ci</td>
<td>17.8182</td>
<td>2.8920</td>
<td></td>
</tr>
</tbody>
</table>

Hypothesis 1, “Korean speakers of English will do worse than native speakers of English in the perception of palatal codas of English,” was partially supported. The Korean speakers of English perceived English palatal codas significantly worse than Americans when the total scores across three sets were compared but did not when scores in each set were compared separately. As far as I know, it is the first report that Korean speakers of English also have perception problems in English palatal codas. The result means that Koreans have a hard time to perceive the difference in words ending with palatal endings and with palatal+i endings. The comparison of total score across sets between words with C and words with Ci among NK also implies that the Korean participants perceived extra [i] after palatal codas, which pattern is similar to the production pattern of palatal codas among Korean speakers. This result may support the idea that perception problems are the source of production problems, if we assume that all participants have problems in producing palatal codas. In other words, it is possible that problems in production might originate from perception difficulties, not just from articulation difficulties. Of course, it is possible that the participants did not have any problem in producing palatal codas of English. However, we cannot exclude the possibility of correlation between perception problems and production problems in L2 speakers. The further research is needed to see the extent of accuracy in perception predicting accuracy in production.

Hypothesis 2, “Korean speakers of English will do worse in perceiving words ending with palatal codas than words ending with palatal+i,” was also partially supported. In set 2, Koreans showed a significant difference in words ending with palatal codas and words ending with palatal+i. Further analysis was conducted. Since set 2 contained affricates and [ʃ], [ʃ] stimuli were omitted from the analysis to examine affricates exclusively. A paired samples t-test showed that there was a significant difference among words with C and Ci endings ($t=-2.16$, $p=0.05$): the participants made more mistakes in perceiving C endings, but did less in perceiving Ci endings. This result might support the idea that it is the release of affricates that triggers the extra vowel perception by Koreans, which does not occur with native speakers of English. However, it is uncertain why extra [i] is perceived among words ending with [ʃ].

The source of [i] insertion can be explained in a different way: This could be because of syllable structure difference between Korean and English. Since Korean does not allow any palatal codas, a vowel is inserted to make the coda as an onset of the following syllable. The reason why [i] is inserted, instead of Korean default vowel [u], is quite natural: it is similar to vowel fronting before palatal consonants in many languages (Hume, 1994). Why do the palatals trigger vowel fronting? It is because palatals and front vowels share the same feature, [-ant]. Furthermore, Hume (1994) argues that front vowels are [COR]. If we assume [i] is different from palatal glide, [j], only in terms of consonant/vowel status, the front high vowel also has [-ant] feature. Of course, palatal affricates are [COR, -ant].

The above phonological explanation is simple and comprehensive in that vowel insertion after [ʃ] (and possibly [ʒ]) is also explained. However, this phonological explanation is based on production. Does production of Korean speakers of English influence the perception of palatal codas of English? In addition, the acoustic quality of English palatal codas might influence the perception and production. One of the possible explanations is the rounding quality of palatals, which lowers pitch. Yoo (1996) also argues that in Korean loanword phonology, Koreans perceive input quality with respect to syllable structure. Further research is needed to examine what acoustic quality of palatal sounds triggered extra [i] perception, and possibly extra [i] production, by Korean speakers of English.

Finally, it is also of interest to see why there was great individual difference among Koreans. Thus, an independent samples t-test was conducted to see the effect of 4 factors, LOR, gender, academic status and English proficiency, on the accuracy of palatal coda perception. However, none of the factors reached significance to explain the individual differences. Two reasons can be speculated. First, the size of each group was small. For example, there were only 4 members in the ELI group in the academic status variable. Second, there might be more important variables that can explain the differences. In particular, motivation
is suspected as an important factor affecting foreign accent. Elliott (1995) noted that "concerns for L2 pronunciation" was the most powerful predictor on pronunciation accuracy. Another factor which was not included in the analysis is aptitude. Purcell and Suter (1980) noted that aptitude for mimicry was the second major factor in pronunciation accuracy, following an L1 factor. Furthermore, input quality might be one of the factors. Even though graduate and non-graduate (i.e., ELI students) factor did not result in any significant difference, it is possible that graduate students had more chance to use and obtain native speakers' input. In Flege and Liu's (2001) study, long LOR did not guarantee success but within a student group, a group with longer LOR did significantly better than a group with shorter LOR in various English tests. Furthermore, the student group did better than the non-student group. The authors concluded that input quality was different between school and non-school settings, and it might have influenced the difference between the student and non-student group.

Furthermore, it is of interest to find that general English proficiency score provided by the TOEFL might not be a good indicator of the perception of English palatal sounds, since the score variable did not show any significance. If so, general English proficiency and accuracy in perception of English might not be related strongly.

To conclude, Korean participants' perception of palatal endings was not the same as that of native speakers of English. In addition, Koreans seemed to perceive an extra vowel in words ending with palatal sounds. The source of misperception of palatal affricates, particularly, might lie in the release of the air stream and in the syllable structure difference between Korean and English. Finally, the four factors, namely LOR, gender, academic status and English proficiency, did not explain the wide individual differences in palatal coda perception by the Korean participants.

5. Implication and further study

Perception and production of second language sounds are said to be related in second language acquisition. One piece of evidence supporting this claim is that the pattern of perception errors and production errors seem similar. For example, in initial position, Korean speakers tend to produce and perceive English [θ] as [s] or [t], and [s] as [ʃ] before high vowels (Joh & Lee, 2001). As for palatal production in final position, Koreans tend to produce English affricate codas with extra [i] vowel (Major and Faudree, 1996). In terms of the perception of palatal codas by Korean learners, the result of the present study partially supports the hypothesis that Korean speakers also hear extra [i] after English palatal codas.

If Korean learners of English have both perception and production problems, then what should instructors of the second language teach, either perception or production alone, or both? My position is that if a learner is not a beginner and time is limited, perception training alone will be enough to improve both perception and production. The evidence can come from both L2 training and L1 clinical training. As for L2 studies, Japanese speakers of English improved both the perception and production of English [r] and [l] by perception training alone (Bradlow et al., 1997, 1999). The Japanese case is different from that of Korean speakers of English, since the latter seem to have more problems in production whereas the former seem to have more problems in perception. Even so, the effect of perception training on Korean L2 learners is worthy of further inquiry. Articulatory training might improve articulation initially, but if the source of the problems in production is determined to be perception but not corrected, the problems might resurface. In addition, when perception or production alone and combination of both trainings of L2 sounds were compared, Perez-Gamboa (1999) claimed that the combination was not as efficient as either type of training separately if given training time was short. L1 clinical training studies also support perception training. For example, Rvachew (1994) trained children who had misarticulation problems in English fricatives, [s, θ, ʃ] with perception training alone. Those fricatives are different in terms of frequency of the spectral amplitude peak of the noise portion. After 2 hours of training, children showed significant improvement both in perception and production of English fricatives. Of course, this does not mean that articulation training is of no use. Beginners should have articulation training as well as perception training. If learners are intermediate and advanced but sustain certain production problems, perception training is one of the ways to help them.

Further study is needed due to several limitations of this research. First, more participants are needed to ensure higher variability and reliability. Second, more stimuli are also needed. In particular, since this study failed to show the source of the misperception of palatal fricative, [ʃ], more stimuli are necessary to compare with other fricatives. Finally, it is of interest to see if other obstruent codas trigger perception of extra vowels by Korean speakers of English. For example, stops with different releasing might elicit
different perception, considering that in final position, Korean stops are not released, while English stops are either released or non-released (Kim, 1998).

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References


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Appendix A. Korean participants' background information

<table>
<thead>
<tr>
<th>No.</th>
<th>TOEFL score range</th>
<th>Length of residence</th>
<th>sex</th>
<th>Academic status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Less than 560</td>
<td>1yr and less</td>
<td>female</td>
<td>graduate</td>
</tr>
<tr>
<td>2</td>
<td>560 and up</td>
<td>1yr and less</td>
<td>male</td>
<td>graduate</td>
</tr>
<tr>
<td>3</td>
<td>Less than 560</td>
<td>1yr and less</td>
<td>male</td>
<td>ELI</td>
</tr>
<tr>
<td>4</td>
<td>Less than 560</td>
<td>More than 1 yr</td>
<td>male</td>
<td>graduate</td>
</tr>
<tr>
<td>5</td>
<td>Less than 560</td>
<td>1yr and less</td>
<td>female</td>
<td>ELI</td>
</tr>
<tr>
<td>6</td>
<td>Less than 560</td>
<td>1yr and less</td>
<td>female</td>
<td>ELI</td>
</tr>
<tr>
<td>7</td>
<td>Less than 560</td>
<td>1yr and less</td>
<td>male</td>
<td>ELI</td>
</tr>
<tr>
<td>8</td>
<td>560 and up</td>
<td>More than 1 yr</td>
<td>male</td>
<td>graduate</td>
</tr>
<tr>
<td>9</td>
<td>560 and up</td>
<td>More than 1 yr</td>
<td>female</td>
<td>graduate</td>
</tr>
<tr>
<td>10</td>
<td>560 and up</td>
<td>More than 1 yr</td>
<td>male</td>
<td>graduate</td>
</tr>
<tr>
<td>11</td>
<td>560 and up</td>
<td>1yr and less</td>
<td>male</td>
<td>graduate</td>
</tr>
</tbody>
</table>

Appendix B. Test stimuli and direction

Set 1
Direction: You will hear sounds, which are not found in English, or Korean. Listen to them carefully, and choose what you heard from the choices on the computer screen.

Audio--Text stimuli)
[lutʃ]—luch, luchi
[lutʃi]—luch, luchi
[mitʃ]—mich, michy
[mitʃi]—mich, michy
[hotʃ]—hoch, hochy
[hotʃi]—hoch, hochy
[ladʒ]—ladge, ladgy
[ladʒi]—ladge, ladgy
[lidʒ]—lidge, lidgy
[lidʒi]—lidge, lidgy
[bidʒ]—bidge, bidgy
[bidʒi]—bidge, bidgy
[nɪʃ]—nish, nishy
[nɪʃi]—nish, nishy
[pɛʃ]—pesh, peshy
[pɛʃi]—pesh, peshy
[nuʃ]—nush, nushy
[nuʃi]—nush, nushy
[tas]—tas, tase
[tasʌ]—tas, tase
[nes]—nes, nese
[nesʌ]—nes, nese
[fos]—fos, fose
[fosʌ]—fos, fose
[lef]—lef, lefe
Set 2
Direction: Some of words that you will hear are real English words and others are not. It does not matter if you know a word or not. Listen and check if the sound you hear is the correct pronunciation of the word as the one on the screen. If it is correct, click “correct,” if not, click “incorrect.”

Text stimuli)
teach    punch    catch
Badge    ledge    huge
Sash     flush    leash
hibachi  Karachi  Obuchi
effigy   elegy    eulogy
Nashy    ashy     bashi

Audio stimuli)
teach    punch    catch×2 (repetition)
Badge    ledge    huge
Sash     flush    leash×2

teachi   punchi   catchi
Badgei   ledgei   hugei×2
Sashi    flushi   leashi

hibachi  Karachi  Obuchi
effigy   elegy    eulogy×2
Nashy×2  ashy     bashi

Set 3
Direction: What you will hear is real English words. It does not matter if you know a word or not. Choose what you hear from the English spellings on the computer screen.

Text and audio stimuli)
Catch    catchy×2 (repetition)
Itch     itchy×2
Peach    peachy
Wedge×2  wedgy
Edge     edgy
Judge×2  judgy
Ash      ashy×2
Dish     dishy
Fish     fishy×2