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Phonological Representations of Stop Sounds in L2A: The Perception of Korean Stops by English and Finnish Speakers

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Kim, Jeong-Young. 2005. Phonological Representations of Stop Sounds in L2A: The Perception of Korean Stops by English and Finnish Speakers. *Linguistic Research* 22.1, 69-88. This study investigates how the phonological representations of stop phonemes in the learner's first language (L1) affects the acquisition of stop sounds in the second language (L2). In order to investigate this issue, perception data was collected from 13 British English speakers and 15 Finnish speakers learning Korean. These three languages were chosen because their stops exploit distinctive features in different ways; in Korean three types of stop phonemes called Tense, Plain and Aspirated exploit [spread glottis] (Steriade 1991, Silva 1992 and Ahn & Iverson 2003), in English voiced and voiceless stops [aspirated], and in Finnish unaspirated voiceless stops and voiced stops [voice]. Based on these facts, two hypotheses are tested in this study: (i) Both English speakers and Finnish speakers will have difficulty in acquiring the distinctions of three different types of Korean stops. (ii) Despite the fact that their L1 feature representations for stops are different from each other, both English and Finnish speakers may show a similar pattern of difficulty in discerning Korean stops. This is because they are facing the same challenge of acquiring the new distinctive feature [spread glottis] in the target language. The results support the hypotheses, showing that (i) both English and Finnish learners were not successful in identifying the three different types of Korean stops and (ii) English and Finnish speakers showed a similar pattern of difficulties in discerning Korean stops regarding the feature [sg]. However, beyond the factor of the feature [sg], the two language groups performed differently from each other in perceiving Korean stops. I claim that the different patterns of error types have been caused by the absence or presence of the geminate in the learner's L1.
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Keywords stop sounds in L2A, Korean stops, the absence or presence of the geminate in the learner's L1

1. Introduction

Early studies on phoneme acquisition in L2A are traced back to Lado (1957). In

his book, *Linguistics Across Cultures*, he stated that the difficulty in acquiring L2 phonemes was owing to phonemes which do not exist in learner's native language, and he called those phonemes 'new'. He claimed, however, that the more persistent difficulty was caused by simple transfer of 'similar' phonemes from the learner's L1 to L2. He described that similar phonemes were the sounds that are physically similar to those of the native language, that structure similarly to them and that are similarly distributed. This concept of 'new' and 'similar' has been also adopted by other studies such as Flege (1987, 1989, 1993 and 1997), Kim and Major (1996), etc. Especially, along with his acoustic experiments of measuring voice onset time (VOT) values, Flege elaborated the notion of 'new' and 'similar'. He stated that 'new' L2 phones have no counterpart in the L1 and so, by definition, differ acoustically from phones found in L1 and 'similar' L2 phones, on the other hand, differ systematically from an easily identifiable counterpart in L1. (Flege 1987: 48) More recently, L2 phonological research (e.g. Archibald 1998; Brown 1998, 2000; Pater 1997, Young-Scholten 1993, etc.) have been carried out in a variety of phonological levels above segments themselves.

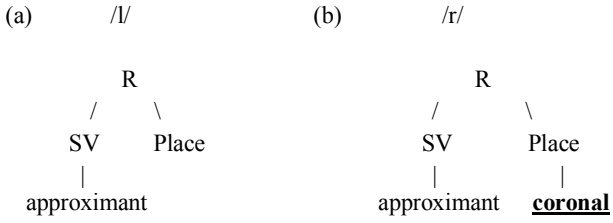
Among various issues in L2A of phonology, this present study deals with perception ability of phoneme contrasts in L2 acquisition. The feature representations of L1 and L2 are considered to explain the L2 learner's perception performance. Therefore, the next section contains a brief outline of the theory of Feature Geometry and some examples of distinctive feature representations in the frame of Feature Geometry.

2. Feature Geometry

The theory of segmental representation known as Feature Geometry appears effective to explain not only phonetic but also phonological phenomena in language acquisition (Archibald 1998; Avery and Rice 1989; Brown 1998, 2000), as it is contained in the phonological component of Universal Grammar, the innate language faculty ascribed to the child by generative theorists. That is, Feature Geometry is regarded to constrain the acquisition process and provides the learner with

information about what phonemic oppositions are possible in natural languages (Brown 2000:12). In order to explain the characteristics of each phoneme and distinguish them from each other, phonetic features have been required. The phonetic features are not unordered feature bundles (Chomsky & Halle 1968) but are internally structured and eventually grouped into a systematic hierarchy of segmental subconstituents (Clements 1985; Sagey 1986). The feature geometry of each segment is unique and distinguishes itself from other segments. However, a feature geometry should minimally specify relevant phonetic features. According to Minimally Contrastive Underspecification, a segmental representation consists of only the information required to contrast it from all other segments in the system; any further specification will be added by a system of phonetic implementation (Avery & Rice 1989). For example, in English, the contrast between lateral approximant /l/ and central approximant /r/ is represented by the feature [coronal] as shown in Figure 1 (Piggott 1993; Brown 1993b, 1995, 2000). On the contrary, the languages which do not have the phoneme contrast of [l] and [r] such as Japanese and Korean, do not have distinct representation. Thus, [l] and [r] are not different phonemes but allophones of a single phoneme in Japanese and Korean. That is why Japanese and Korean learners of English have difficulties in perceiving the English /l/ and /r/ (Brown 1998 and 2000).

Figure 1. Segmental Representations for English /l/ and /r/ (from Brown 2000)



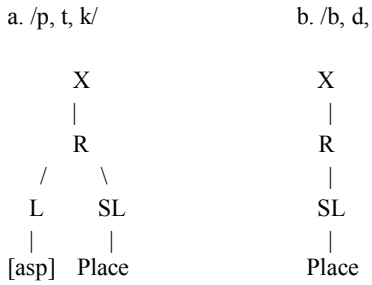
3. Analysis of Stops in Light of Feature Geometry

3.1 Distinctive Features of English Stops

There are two way distinctions, voiced /b, d, g/ and voiceless /p, t, k/ in English

stops. In English, the feature [aspirated] (henceforth, [asp]) on the laryngeal node enables English speakers to distinguish voiceless stops from voiced ones. Both types of the English stops occupy a single-timing slot.

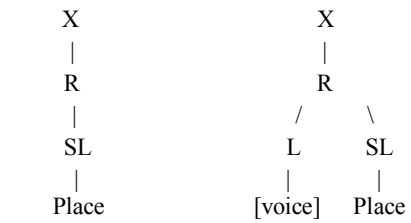
Figure 2. Distinction between Voiceless and Voiced Stops in English



3.2 Distinctive Features of Finnish Stops

There are also two way distinctions, voiced /b, d, g/ and voiceless /p, t, k/ in Finnish stops. However, in Finnish, it is the feature [voice] on the laryngeal node that enables Finnish speakers to discern voiced stops from voiceless ones. This is because /p, t, k/ are not aspirated unlike in English (Vähämäki 2000: xii; Leney 1999: 10). Besides, these Finnish stops are always single-timing slotted in the word initial position. It should be also noted that in Finnish, geminates appear only in the word-medial position as double consonants of an unaspirated voiceless stop.

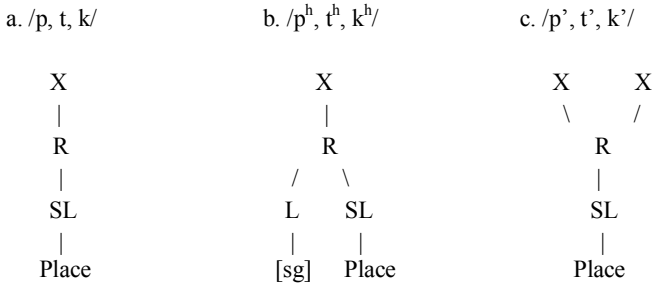
Figure 3. Distinction between Voiceless and Voiced Stops in Finnish



3.3 Distinctive Features of Korean Stops

On the other hand, Korean stops are classified in three ways of distinctions, which are called *Aspirated, Plain* and *Tense*. None of them are voiced. Korean does not have voiced stops at the underlying level. The laryngeal node of plain stops is bare, the feature [spread glottis] (henceforth [sg]) is marked to be pronounced as /p^h, t^h, k^h/, heavily aspirated stops (Steriade 1991; Silva 1992; Ahn & Iverson 2001, 2003)[1]. The feature [sg] plays the key role for the distinction between aspirated stops and plain stops, both of which are single-timing slotted. However, tense stops (glottalised in Korean), having two-timing slots, are distinguished from the other two types of Korean stops at the prosodic level as well as by the distinctive feature [sg].

Figure 4. Three Ways of Distinctions of Korean Stops



4. Data Collection

4.1 Research Subjects

Thirteen British English speakers and fifteen Finnish speakers were investigated in

[1] This study follows Ahn & Iverson's (2003) claim that Korean has the laryngeal feature [sg] for aspirated stops and tense stops are the geminates of plain stops. S-H Kim (1990) and Han (1992) also argued that Korean tense stops are 'geminate plain consonants'. Especially, Han noted that the Korean plain and tense consonants are distinguished by both structural and featural specifications. However, it is still under debate how to make distinctions in the three types of Korean stops.

order to look at the acquisition of the three Korean stop triplets; plain stops /p, t, k/, aspirated stops /p^h, t^h, k^h/ and tense stops /p', t', k'/. The English and the Finnish subjects are divided into three parts according to their developmental stages: Inexperienced I (5 English and 5 Finnish speakers), Inexperienced II (5 English and 5 Finnish speakers) and Experienced (3 English and 5 Finnish speakers). The learners in the groups of Inexperienced I and II learnt Korean in their native countries for one year and for two years respectively. On the other hand, the learners in the group of Experienced lived in Korea between one and three years in total and took a formal Korean language course for at least one academic year in Korea.

Data from 13 English speakers were collected either at the University of Durham, at the University of Newcastle or at SOAS, England. On the other hand, all the 15 Finnish speakers participated in the data collection at the University of Helsinki, Finland. The 28 English and Finnish research subjects started learning Korean at university. Before then, they hardly had an opportunity to be exposed to Korean. Apart from the 28 subjects, two more people participated in the experiment in England. However, their data were discarded because one of them reported that he was an English and French bilingual and the other had overheard Korean since her birth.

As a control group, 10 Koreans from Seoul, where the standard Korean is spoken were included in this experiment. Data from four of them were collected in England, another four in Finland and the last two in Korea. Korean controls accurately performed 100% without a single mistake in the auditory task.

All the participants in the perception experiment reported having normal hearing. Details of the research subjects are summarised in Table 1.

Table 1. Subject Information

Group	Mean age at testing	Mean age at exposure	Mean years studied	Mean years in Korea (Experienced)
English	22.92	21	2	1.67
Finnish	25.15	22.46	2.67	1.4
Controls	27	--	--	--

4.2 Auditory Discrimination Task

4.2.1 Test Material and Procedure

Twenty seven syllables in the form of CV were recorded into an MD player (Panasonic FE9LF09096) by the experimenter, who speaks the standard Seoul Korean. The three Korean triplet phonemes (i.e. /p, p', p^h/, /t, t', t^h/ and /k, k', k^h/) were combined with a simple vowel, either /a/, /e/, or /u/ in order to assemble a syllable. The triplet phonemes combined with the vowel /a/ were presented to the subjects first, with /e/ next and lastly with /u/. The consonant phonemes were randomised in order within the same vowel group. (The transcribed task material is presented in Appendix.) The twenty-seven stimuli were presented one by one in a task which involved matching one out of three sounds in the same group of triplet stop phonemes by listening to the recorded sounds from the MD player through a set of earphones. Each subject was tested individually in a quiet room, and the subjects were asked to mark the column 'Not sure' in case of uncertainty.

4.2.2 Rational for the Auditory Experiment

Departing from VOT Research: This present study departs from the VOT perception research by presenting the natural native Korean speaker's voice as stimuli in the experiment. I avoid using sounds generated by speech synthesis for the following reasons. Firstly, I assume that language acquisition is stimulated by natural input produced by human so that the learner may generate his/her grammar. Thus, I prefer using the target language speaker's utterances to test L2 learners' perception ability. Secondly, it is phonological representations including distinctive features in L2 that are investigated in this study, rather than the difference between L1 and L2 speakers' VOT values. Native Korean speakers categorically perceive Korean stops, which can be phonologically classified into three different categories of *Aspirated*, *Plain* and *Tense* by distinctive features and other phonological factors. I suppose that the distinction of Korean stops may not solely lie on discrimination of VOT values

but may rather be more relevant to phonological acquisition of distinctive features and phonological rules in Korean. Besides, the acoustic study of Cho et al. (2002), which examined native Korean speakers' stop production remarked that VOT values might not be the crucial cue for native Korean speakers to perceptually discern the three distinctions of stops in Korean. Furthermore, to my observation of literatures reporting VOT values of English /b, d, g/ and Korean /p', t', k'/[2], they appear very close to each other as far as concerning the VOT measurements alone, despite the fact that they are classified into two distinctive types of sound qualities. That is, English /b, d, g/ are voiced, but Korean /p', t', k'/ are unaspirated voiceless sounds. Curtin et al (1998: 392) also avoided using VOT measurements in exploring the perceptual acquisition of Thai stop phonemes by English and French speakers. Opposed to the phoneme identification and discrimination tasks used in the VOT research, they stated that those tasks measure only the identification of sounds with native language categories and the ability to distinguish minimally different sounds. The constrast under investigation was restricted to onset position as in the present study, although their stimuli were words in CVC syllables.

Non-lexical CV Syllables: This study specifically looks at the acquisition of Korean 'stop phonemes' independent of any other factors such as syllable structure, consonant cluster, lexical representation, etc. For this reason, I intended to prevent the subjects' perception from being affected by their lexical knowledge (Yamada, Kobayashi and Tohkura 1997), assuming that the stop in a non-lexical CV form may be the most appropriate way to examine its segmental information alone.

Perception Tested: Since adult learners have a developed motor control system, they are often able to execute the necessary articulations. With additional information from orthography, the learner may be able to produce the correct sound accurately, thus giving the appearance of having acquired the contrast. Therefore, as Brown (1998: 157) remarked, if we rely on production data we may be misled to attribute more segmental structure to a learner's underlying phonological competence than he or she actually has. If L2 learners who can accurately produce a non-native contrast

[2] The mean VOT values of English and Korean stop sounds are as following: English /p, t, k/-69ms, English /b, d, g/-9ms, Korean /p^h, t^h, k^h/-126ms, Korean /p, t, k/-61ms and Korean /p',

might not be able to distinguish the two sounds perceptually (see Brière 1966; Goto 1971; Sheldon & Strange 1982; Flege 1995), we need determine this by routinely making use of tests to investigate perceptual discrimination.

'Not Sure': Lastly, I provide the reason why the column 'Not sure' was added in the answer sheet. I suppose that most of English and Finnish learners of Korean are unable to hear the difference among the three types of Korean stops. If the subjects in this present study had only three options (i.e. Aspirated, Plain and Tense) for the response to the stimuli, they would have to randomly select one out of the three options even when they do not hear the difference among the three distinctions. In case he or she hears the three distinctive stops the same[3] but are still forced to identify the stimuli with one of the three stops as a guess in the answer sheet, the results will appear random rather than systematic. It will make it more difficult for us to detect how L2 learners perceive the three distinctions of Korean stops. Thus, to reduce the possibility that the subjects randomly choose one out of the three different types of stops, the column 'Not sure' has been added in the answer sheet.

5. Results and Discussion

5.1 Comparison of Different Language Groups

In order to compare the English and Finnish groups' performances to one another, the errors for each column of 'Aspirated', 'Plain' and 'Tense' were calculated into percentages (See Table 2 and 3), which is illustrated in Chart 1.

For aspirated stops, the English subjects scored 64.91% and the Finnish subjects 60.26%. The two language groups appear very similar to each other regarding the perceptual ability to discern aspirated stops despite the fact that the feature representations of English and Finnish stops are different from each other, as illustrated in Section 3. On the other hand, the English and Finnish subjects show differences, although insignificant, in the perception of plain and tense stop stimuli.

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t', k'/-13ms. (calculated from the reports provided by Silva 1992 and Han & Weitzman 1970)

[3] This is easily observed in the Korean class. Students have reported that they do not hear the

For plain stops, the English subjects performed 52.63% correctly and the Finnish subjects 64.24%. For tense stops, the English subjects scored 82.46%, and the Finnish subjects 74.50%. These scores are significantly higher than those for the two other types of stops.

The figures demonstrated in Table 2 and 3 will be further discussed with the analysis of error types in the next section.

Chart 1. Overall auditory performance by group

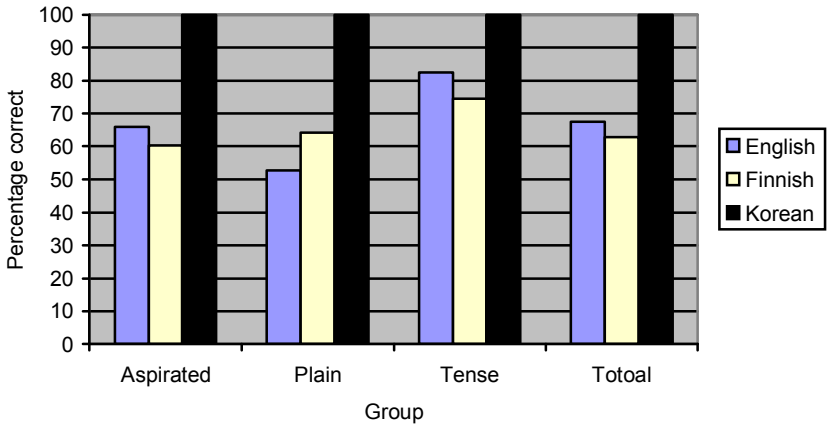

Table 2. English Performance Auditory Task

	Aspirated	Plain	Tense	Percentage correct in total (%)
Percentage correct	64.91	52.63	82.46	**67.52**

Table 3. Finnish Performance Auditory Task

	Aspirated	Plain	Tense	Percentage correct in total (%)
Percentage correct	60.26	64.24	74.50	**62.72**

differences of the three types of Korean stops, especially before learning the Korean alphabet.

5.2 Comparison of the Error Types and Frequencies

Starting with 'Errors in identifying aspirated stops' of Table 4, both of the English and Finnish subjects tend to mismatch aspirated stops with plain stops (77.5% for English and 80% for Finnish) but not with tense stops. There was only one error of mismatching the aspirated stop with the tense stop, and the rest of their errors were marked as 'Not sure'. This phenomenon implies that 20% of 'Not sure' may have been caused by the confusion between aspirated stops and plain stops rather than between aspirated stops and tense stops. In other words, the two groups of subjects were able to make (almost) native-like distinction between aspirated stops and tense stops when aspirated stops were given as stimuli. Thus, I presume that 'Not sure' in identifying aspirated stops is a grey area only between aspirated and plain stops but not between aspirated and tense stops to English and Finnish speakers. On the other hand, I suggest that feature acquisition of phonemes should be considered independent of prosodic and suprasegmental factors, as no feature in L1s of English and Finnish speakers plays the role for the distinction between aspirated and plain stops or between aspirated and tense stops.

Table 4. Errors in Identifying Aspirated Stops

	Plain		Tense		Not sure		Total	
	Eng	Finn	Eng	Finn	Eng	Finn	Eng	Finn
Number of errors	31	48	1	0	8	12	40	60
Error rate (%)	77.5	80.00	2.50	0	20.00	20.00	100	100

Table 5. Errors in Identifying Plain Stops

	Aspirated		Tense		Not sure		Total	
	Eng	Finn	Eng	Finn	Eng	Finn	Eng	Finn
Number of errors	31	28	17	7	6	19	54	54
Error rate (%)	57.41	51.85	31.48	12.96	11.11	35.19	100	100

Table 6. Errors in Identifying Tense Stops

	Aspirated		Plain		Not sure		Total	
	Eng	Finn	Eng	Finn	Eng	Finn	Eng	Finn
Number of errors	6	4	9	20	5	13	20	37
Error rate (%)	30.00	10.81	45.00	54.05	25.00	35.14	100	100

In Korean, aspirated and plain stops are distinguished by the feature [sg], but the distinction for tense stops with double-timing slots is beyond the level of features and needs to be considered on the prosodic level, too. I assume that the clear distinction between Korean aspirated and tense stops in English and Finnish learners' minds is guided not only by the feature [sg] but also the timing unit. On the contrary, English and Finnish speakers are not so successful for the discrimination between Korean aspirated and plain stops where there is no distinction on the prosodic level, showing the high error rates of 77.5% by English speakers and 80% by Finnish speakers.

Now, we turn to the error types when tense stops were presented as stimuli. The results for tense stops in Table 2 and 3 show that English subjects accurately performed 82.46% and Finnish subjects 74.50%. These figures are significantly higher than when aspirated stops or plain stops were presented as stimuli. In other words, English and Finnish speakers may find it easier to discern a tense stop with double-timing slots from an aspirated or a plain stop with a single-timing slot than other types of Korean stop discriminations. One thing that should be paid attention to here is that tense stops are geminates of plain stops, not of aspirated stops. Grounded on this fact, I suppose that the discrimination between tense stops (as stimuli) and plain stops should not be as successful as the discrimination between tense stops (as stimuli) and aspirated stops for L2 learners of Korean. For instance, suppose that we have AA standing for a geminate of A and B as a third segment. It might be even easier to discern AA from B than from A. Besides, it is possible for L2 learners to be influenced by their knowledge of geminates in their L1. However, I do not mean that L1 knowledge of the geminate will help L2 learners to learn geminates in the target language better. Remember that the English subjects who lack geminates in their L1

were also native-like for the discrimination between aspirated stops and tense stops. Still, I presume that L1 grammar regarding geminates will play a certain role in L2A of Korean stops whether it may be positive or negative. Then, with regard to this presumption, let us examine the English and the Finnish subjects' error types in the performance for the tense stop discrimination. English speakers who lack of geminates in their L1 did not show significant differences among mismatches of tense stops with other options (i.e. either 'Aspirated', 'Plain' or 'Not sure'). Within the incorrect responses of 20 errors in discerning tense stops from others, the percentages of mismatches to 'Aspirated', to 'Plain' and to 'Not sure' were 30%, 45% and 25% respectively (See Table 6). These percentages have come to 5.25%, 7.89% and 4.39% respectively among the total number of 114 errors. The figures imply that they do not discriminate between the two single-slotted segments, aspirated and plain stops. If they had differentiated the two types of single-timing slotted Korean stops from each other, they would have shown a certain preference by selecting either of them more frequently rather than marking the three incorrect options (i.e. 'Aspirated', 'Plain' and 'Not sure') evenly. However, they did not reveal a particular tendency for a certain type of stops at all. Thus, I posit that the English subjects are unable to successfully distinguish non-geminate stops from each other although they can distinguish stop geminates from non-geminate stops in the word-initial position, by showing the higher percentage correct for the tense stop discrimination.

Now, we analyse the Finnish subjects' performance in identifying stimuli tense stops. Finnish allows geminates in the word-medial position but never in the word-initial position. Owing to their knowledge about the position of geminates in a word, Finnish speakers may be confused between tense stops and plain stops in Korean. That is, when Finnish speakers hear Korean tense stops in the word-initial position, their L1 grammar could influence them to misjudge the tense stops as plain stops rather than aspirated stops. Their sensitivity to geminate sounds may lead them to acknowledge AA (tense stops) as A (plain stops) as in Finnish whilst English speakers unfamiliar with geminates have no preference for either A or B. Therefore, this Finnish speakers' confusion between AA and A will lead them to mark 'Plain' relatively more frequently than 'Aspirated'. In addition, I suppose that this confusion

could lead the Finnish subjects to mark 'Not sure' more often than the English subjects. Looking at the figures, the percentages of mismatches to 'Aspirated', to 'Plain' and to 'Not sure' were 10.81%, 54.05% and 35.14% respectively out of the incorrect responses of 29 errors in discerning tense stops from the others. These percentages have come to 2.65%, 13.25% and 8.61% respectively among the total number of 151 errors. Unlike the English subjects, the mismatch percentages of the error types in the Finnish speakers' tense identification performance are not even. The mismatch percentage for 'Plain' is the highest and the mismatch percentage for 'Aspirated' the lowest. Thus, the figures strongly suggest that the learner's knowledge about geminate affects error types.

Based on the analysis of error types given so far, we may put forward some predictions regarding errors in identifying stimuli plain stops. Firstly, both Finnish and English speakers will be better in discerning plain stops from tense stops than in discerning them from aspirated stops. Secondly, Finnish speakers may have tendency to mismatch word-initial plain stops with aspirated stops than tense stops because they have the L1 knowledge that geminates are forbidden in the word-initial position. Still, Finnish speakers may detect the difference between a plain stop with a single-timing slot and a tense stop with double-timing slots, as Finnish has geminates although not in the word-initial position. The contradiction between this detection and their L1 knowledge about geminates could lead them to respond to mark 'Not sure' more frequently than English speakers. Lastly, it is expected that the distinction between plain stops and tense stops may not be as clear as that between aspirated stops and tense stops to both English and Finnish speakers. This is owing to the fact that a tense segment in Korean is assumed to have two plain segments at the prosodic level of the segment structure. Accordingly, it is presumed that L2 learners of Korean are more successful to discriminate a double-timing slotted segment (i.e. tense stops) from a different type of a single-timing slotted segment (i.e. aspirated stops) rather than from the same single-timing slotted segment as in the geminate (i.e. plain stops). Although not as perfect as for the distinction of aspirated stops from tense stops, English and Finnish speakers must be better in discerning pain stops from tense stops than in discerning two single-timing slotted segments from each other.

In Table 5, the English subjects' results show us that out of the incorrect responses of 54 errors in discerning plain stops from others, the percentages of mismatches to 'Aspirated', to 'Tense' and to 'Not sure' were 57.41%, 31.48% and 11.11% respectively. These percentages have come to 27.19%, 14.91% and 5.26% respectively among the total number of 114 errors. On the other hand, the Finnish subjects' results show us that out of the incorrect responses of 54 errors in discerning plain stops from others, the percentages of mismatches to 'Aspirated', to 'Tense' and to 'Not sure' were 51.85%, 12.96% and 35.19% respectively. These percentages have come to 18.54%, 4.64% and 12.58% respectively among the total number of 151 errors. In identifying stimuli plain stops, the English subjects discriminated them from tense stops better than from aspirated stops by 15.93%, and the Finnish speakers by 38.89%. By these figures was the first prediction supported, and the figure 38.89%, the gap made by the Finnish speakers specifically supports the second prediction. The figure 35.19% for 'Not sure' made by the Finnish subjects is larger than the English subjects' figure 11.11% for 'Not sure', which proves that Finnish speakers may be more confused than English speakers in discerning the word-initial plain stops because of the two contradictory facts in Finnish speakers' mind.

In summary, although both the English and the Finnish subjects demonstrated lower figures for the discrimination between plain stops and tense stops than for the discrimination between two single-timing slotted segments (i.e. plain stops from aspirated stops), the figures of these error types are still higher than those in the error types of the discrimination between aspirated stops and tense stops. Consequently, I infer that it is easier to discern AA (tense stops) from B (aspirated stops) than from A (plain stops). This is because aspirated stops (B) are distinguished from tense stops (AA) by the timing unit as well as by the distinctive feature [sg] whereas plain stops (A) are distinguished solely by the timing unit.

All the figures of each error type calculated in percentage out of the total error numbers are demonstrated in Table 7.

Table 7. Comparison of Error Types out of Total Errors Made by Each Group (%)

	Aspirated		Plain		Tense		Not sure	
	Eng	Finn	Eng	Finn	Eng	Finn	Eng	Finn
Aspirated	--	--	27.19	31.79	0.88	0	7.02	7.95
Plain	27.19	18.54	--	--	14.91	4.64	5.26	12.58
Tense	5.26	2.65	7.89	13.25	--	--	4.39	8.61
Total number of errors	English subjects: 114 (100%) Finnish subjects: 151 (100%)							

*Note: 'Aspirated', 'Plain' and 'Tense' on the leftmost column refers to the types of stops given as stimuli, and 'Aspirated', 'Plain', 'Tense' and 'Not sure' on the top row indicate the options for response to the stimuli.

Abbreviations: Eng - the English subjects, Finn - the Finnish subjects

6. Conclusion

I attempted to provide the reason for the perception difficulty in L2A of Korean stops through a phonological approach, departing from the examination of VOT measurements. The findings regarding the relation between L2A of Korean stops and the Korean distinctive feature [sg] have supported the claim that only those features represented in the learner's L1 result in perceptual sensitivity to particular non-native contrasts in L2A (Brown 2000). Besides, it was found that L2 learners distinguish the phoneme contrast caused by the timing unit (i.e. geminate vs. non-geminate) more successfully than the phoneme contrast caused by the distinctive feature. This finding suggests that phonemic acquisition is not limited to the matter of acquiring only features of a phoneme but should be investigated beyond the level of features.

In conclusion, the following was discovered concerning the hypotheses presented in Section 1: (i) The English and the Finnish subjects performed better to discern geminates from non-geminate segment in general. Especially, the two language groups of subjects were native-like in discerning the geminate (AA) from the non-geminate (B) but not from the other non-geminate (A). On the other hand, the Korean stops distinguished by the feature [sg] alone have appeared the most difficult

for the L2 learners of Korean to acquire. (ii) It is likely that English and Finnish speakers show a similar pattern of difficulties in discerning Korean stops regarding the feature [sg]; however, differences between the two language groups were also found in the acquisition of Korean stops. According to the analysis of data in this present study, the different patterns of error types are caused by the absence or presence of the geminate in the learner's L1.

Acknowledgements

I would like to thank my supervisor, Dr. Martha Young-Scholten for her invaluable help and support.

Appendix

Matching the Identical Phonemes

		A	B	C	Not sure
1	ka	ka	k^ha	k'a	
2	p^ha	pa	p'a	p^ha	
3	ta	t^ha	ta	t'a	
4	k^ha	k'a	ka	k^ha	
5	pa	p'a	pa	p^ha	
6	t'a	t^ha	t'a	ta	
7	k'a	k'a	k^ha	ka	
8	p'a	pa	p'a	p^ha	
9	t^ha	ta	t^ha	t'a	
10	t'e	te	t^he	t'e	
11	pe	p^he	p'e	pe	
12	k^he	ke	k^he	k'e	
13	te	t^he	t'e	te	
14	p^he	p'e	p^he	pe	
15	ke	k^he	ke	k'e	
16	t^he	t'e	t^he	te	
17	p'e	p'e	p^he	pe	
18	k'e	ke	k'e	k^he	
19	k^hu	ku	k^hu	k'u	
20	pu	pu	p'u	p^hu	
21	t'u	t^hu	tu	t'u	
22	k'u	k'u	k^hu	ku	
23	p'u	p^hu	p'u	pu	
24	t^hu	tu	t^hu	t'u	
25	ku	ku	k^hu	k'u	
26	p^hu	p'u	pu	p^hu	
27	tu	t'u	tu	t^hu	

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