



Vowel length difference before voiced/voiceless consonants in English and Korean

Seung-Jae Moon*

Abstract

The existence and the extent of vowel length difference before voiced/voiceless consonants in English and Korean are examined in three groups: (1) Korean-speaking Americans (group *A*), (2) immigrants who moved to the U.S. in their early teens (group *I*), and (3) Koreans who have been in the U.S. for less than 3 years (group *K*). 14 subjects were recorded reading 10 English and 10 Korean sentences. The results show that the three groups exhibit different patterns of the vowel length difference: Group *A* shows a very strong tendency of vowel lengthening before voiced consonants in both English and Korean, while Group *I* shows less degree of vowel lengthening, and Group *K* shows almost no tendency of vowel length difference in both languages. This strongly suggests that, (1) unlike English, Korean does not have the vowel length difference depending on the following consonants, and (2) the vowel lengthening effect observed in Korean (L2) speech in group *A* may be the result of transfer of the phonetic trait acquired in English (L1). It also implies that, in teaching pronunciation, some facts such as the vowel length difference cannot be expected to be acquired automatically for the learners of English, but have to be taught explicitly.

Keywords: teaching pronunciation, English pronunciation, language transfer, vowel duration, vowel length, voiced/voiceless consonants, Korean, transfer of phonetic traits

1. Introduction

Quite frequently one notices certain kinds of distinctive accent when he encounters a native speaker of English speaking fluent Korean. Even though the speaker may be fluent in Korean, there are some things which betray the fact that Korean is not their mother tongue. Those foreign accents may be the result of transfer of some phonetic traits from one language to another. (Here, the term “transfer” is used in the traditional sense as “the influence resulting from the similarities and differences between the target language and any other language that has been previously (and perhaps imperfectly) acquired” (Odlin, 1989)).

“Language transfer” has been studied in a very wide range of areas. For example, cross-linguistic influence in each subsystem is

covered in Odlin (1989) extensively. Among many topics of transfer, the age factor will be the main focus of this paper. The present study investigates the existence and the extent of the transfer of one specific phonetic trait: vowel-length difference before voiced and voiceless consonants.

It is a well-established fact in English that vowels are longer before voiced consonants than the same vowels before voiceless consonants (hereafter referred to as the vowel length difference or VLD) (House, 1961; House & Fairbanks, 1953; Ladefoged, 2007). The phenomenon has been observed in many languages such as Dutch (Slis & Cohen, 1969), Danish (Fischer-Jørgensen, 1964), Hindi (Maddieson & Gandour, 1975), French, Russian, and Korean (Chen, 1970). Chen (1970) reported the finding of VLD in Korean even though the ratio of vowels before voiceless consonants to

* Ajou University, moon@ajou.ac.kr

Received 1 November 2017; Revised 7 December 2017; Accepted 8 December 2017

vowels before voiced consonants was higher in Korean than in English. Kim (2011) found even higher ratio in Korean. But neither of them offered any statistical data for their data in that respect.

There have been many attempts at explaining the phenomenon. Some tries to explain it in terms of production mechanism of speech (Chen, 1970; Lisker, 1974), with many others making counter-claim (Peterson & Lehiste, 1960; Sharf, 1962). There were also some who gave auditory explanations (Javkin, 1976; Kluender *et al.*, 1988) while Fowler (1992) argued strongly against Kluender *et al.* (1988).

However, the scope of the current study is not the phonetic aspect of the VLD *per se*, but the implication of the existence, if any, and the extent of VLD in English education.

With Chen (1970) being the only literature which claims the existence of VLD in Korean, but without any plausible explanation for the phenomenon, this study started with verifying whether Chen (1970)'s finding is replicable by investigating native Korean subjects. Then the results will be compared with two other groups: one group of native Americans who can speak Korean, and the other group of Americans who immigrated in their early teens.

2. Production Experiment

The current study starts with the following questions:

- (1) Does the VLD exist in Korean?
- (2) Is the trait of the VLD transferred? In other words, will the native speakers of English, with the strong VLD in their mother-tongue, show more prominent VLD when they speak Korean than native Koreans do?

To attempt to answer these questions, a production experiment was conducted in which subjects record English and Korean sentences.

2.1. Subjects

Three groups of subjects were recruited to check whether there was any manifestation of the VLD in English and Korean.

The first group consisted of five Americans (aged 12, 14, 16, 29, and one in her forties, hereafter referred as group *A*).

They were all born in the U.S. and, when asked, they think of themselves as Americans exclusively. Nobody considered himself/herself as Korean. All of their immediate families speak mainly Korean among themselves. The English level of the family members are not high enough to carry out conversations in fluent English.

The subjects in group *A* could speak Korean well enough to carry out conversations with native Koreans. When they speak in Korean, though, they do have some accent distinguishable from a native Korean. The subject in her forties was the only one who could read Korean. For the rest of four subjects, Korean sentences were read to them by the experimenter and they repeated those sentences. All of them knew what those sentences meant without any explanation.

The second group consisted of four Americans (hereafter referred as group *I*) all in their twenties.

They all came to the U.S. as immigrants with their families in their early teens (between 11 and 13 years old) except for one who came at the age of 7. They graduated from junior-high and high-schools in the U.S. public school system, and they were now working or in college. When asked their nationality, they consider themselves as American, but at the same time, they answered they

were Korean even though they acknowledged the fact that their official nationality was different.

They are all fluent in Korean without any difficulty reading Korean. Their parents speak exclusively Korean among their family members. They all sound like native Korean but when they speak English, there are still some detectable foreign accent.

The third group consisted of five Koreans (hereafter referred as group *K*). All of them were teenagers and they had come to the U.S. to study in a high-school two to three years ago except one, in his forties, who had studied in the U.S. for 10 years in his twenties about 10 years ago. All four teenagers had not been in the U.S. before.

2.2. Materials

Two sets of sentences were used for the recording and measurement: English and Korean. Five pairs of sentences were selected for each language set.

Great care was taken to make all stimuli to communicatively meaningful, unlike Chen (1960) and Kim (2011), who used non-sense syllables. At the same time, it was tried to make both language sets as phonetically close as possible. But due to the difference between two languages, it was not possible to come up with perfectly matched sets. Different vowels were included to ensure that the VLD, if any, was not vowel-specific: [æ, i, ai, ou] for English and [u, a, ʌ, i] for Korean. Standard Korean has seven monophthongs. However, only four vowels were included to make the sentences as realistic as possible.

Choosing English sentences was relatively simple: it was just a matter of finding minimal pairs. However, the situation was not that simple with Korean. Unlike English, Korean obstruents do not have a voiced/voiceless distinction. All Korean obstruents are phonologically voiceless. In addition, all obstruents are voiceless not only phonologically but also phonetically as well at the end of a syllable. Therefore, to come up with the voiced/voiceless distinction in pronunciation comparable to English, the fact had to be exploited that, in Korean, phonetically voiced obstruents do occur as allophones mainly between vowels.

For example, in Korean, /pal/ ('foot') and /p^hal/('arm') all start with voiceless stops. But when a demonstrative word [i] ('this') comes in front of these words, /p/ changes into [b], a fully voiced bilabial stop, thus [ibal], while /p^h/ remains voiceless as [ip^hal].

It was very challenging to find the words which would fit into these criteria while they were not too difficult or exotic for the subjects to understand and produce, especially for those in groups *A* and *I*.

When considering sentences for Korean language for the current study, it was imperative that all sentences should make sense, so that subjects felt comfortable to produce those sentences.

Considering the facts described above, the following 10 pairs of sentences (5 pairs for each language) were chosen. The focus vowels, whose duration was measured, are underlined.

English sentences:

- (1) Take a cab now./Take a cap now.
- (2) It was a small league./It was as mall leak.
- (3) What a great prize!/What a great price!
- (4) This is an old rag./This is an old rack.
- (5) Use that robe over there./Use that rope over there.

Korean sentences (in phonetic transcription according to IPA, with meaning in parentheses):

- (6) [inguginin undonjil adju dʒoaheyo] (Ingook(*first name*) likes sports very much.)
 /[inguk^hinin undonjil adju dʒoaheyo] (In(*last name*) Gooki(*first name*) likes sports very much.)
- (7) [nalsiga ʃam tagamneyo] (The weather is very warm.)
 /[sadʒʌŋi ʃam tak^haneyo] (The situation is very pitiful.=I feel very sorry.)
- (8) [igəl ʌbʌ boseyo](Try to carry this on your back.)
 /[igəl ʌp^hʌ boseyo] (Try to overturn this.)
- (9) [ibaril dirə boseyo] (Try to raise this foot.)
 /[ip^haril dirə boseyo] (Try to raise this arm.)
- (10) [idari ʃ^ham kʌ boineyo] (This Moon looks very big.)
 /[it^hari ʃ^ham musʌwʌ boineyo] (This mask looks scary.)

2.3. Recording

These five pairs of sentences for each language were repeated three times, and then randomized, which yielded 30 sentences for each language set. For each set, the sentences were written in its own language, that is, Korean set was written in Korean, English set in English. Each set is written in two pieces of paper, and presented to the subjects.

Each subject sat in a small quiet room with a headset with microphone in front of a laptop computer with the experimenter. They were instructed to read, or (repeat after the experimenter for group A) as naturally and comfortably as possible. No other instruction was given. Whenever they made a mistake, they were asked to repeat the sentence again by the experimenter.

2.4. Measurement

The recordings were digitized into separate files according to subjects and sets at 22,050 Hz sampling frequency using a speech analysis program Praat (Boersma & Weenink, 2015). Therefore twenty-eight files (14 subjects x 2 language sets) were created in total.

Then, for each word containing the target vowel for measurement, the duration of the vowel was measured in milliseconds using Praat.

Only two words, *cab* and *cap*, made the measurement of vowel duration straightforward. It was a simple matter to find the closure of the preceding consonant and the opening of the following consonant.

For the rest of the words, it turned out that it was almost impossible to measure the vowel duration accurately and consistently if the meaning of ‘vowel duration’ was to be interpreted literally. It was very difficult to find the beginning and ending of a vowel in any of those words.

The liquids ([l] and [r]), for example, are very sonorant and there is not a clear distinction between liquids and the following vowels. In Korean data, most of voiced segments are totally voiced to the extent of becoming fricatives rather than the intended stops. As a result, there was not any indication of total closure which might signal the beginning and ending of a vowel. (In a sense, this confirms that the subjects followed faithfully the instruction to utter those sentences as naturally and comfortably as possible.)

However, the focus of this experiment is the relative duration difference of a vowel before voiced/voiceless consonants, not the vowel duration *per se*. Therefore, this difficulty of measuring vowel duration accurately could be circumvented as long as the same criteria were applied consistently throughout the data.

The following criteria were used to measure and compare the vowel duration of the data.

For *robe/rope*, *rag/rack*, the vowel duration was defined as the duration from the lowest third formant of [r], which indicates the fullest articulation of [r], to the closure of the consonants after the vowel.

For *league/leak*, the vowel duration was defined as the duration from minimum intensity during [l], which indicates the fullest articulation of [l], to the closure of the consonants after the vowel.

For *prize/price*, the vowel duration was defined as the duration from the opening of [p] to the beginning of [s, z] due to the lack of acoustic signal for [r] after [p].

For the fully voiced Korean words which became fricatives, the vowel duration was defined as the duration from voice onset time point of the target vowels to the intensity minimum of the following consonants.

3. Results

3.1. Big Picture: ANOVA

Since our interest is in finding out whether VLD exists in each language, the results from two language sets were separately analyzed with analysis of variance as the VLD (expressed as “before voiced–before voiceless” value) as a dependent variable.

3.1.1. English data

Paired sample statistics for each group for each word are given in <Table 1>, and the descriptive statistics of English data are given in <Table 2>.

Table 1. Paired Sample Statistics for Each Group

Word ^a	Group A(n:5)		Group I(n:4)		Group K(n:5)		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
E	<u>cab</u>	228.2	29.0	186.3	37.9	165.4	32.0
	<u>cap</u>	196.6	24.5	180.0	23.3	156.2	28.9
n	<u>league</u>	215.0	35.0	184.5	18.2	207.6	28.8
	<u>leak</u>	150.0	27.2	124.8	5.4	149.6	20.5
g	<u>prize</u>	361.2	65.2	343.3	55.2	337.4	108.0
	<u>price</u>	235.8	40.3	271.3	47.2	284.4	62.4
i	<u>rag</u>	300.4	34.9	251.0	38.8	257.0	60.9
	<u>rack</u>	219.4	25.8	190.3	14.5	222.6	56.4
h	<u>robe</u>	201.0	27.0	192.5	44.3	230.4	55.2
	<u>rope</u>	172.4	32.2	163.5	51.9	245.0	85.5
K	<u>gugi</u>	149.0	27.1	103.5	6.8	93.4	15.4
	<u>guk^hi</u>	102.4	21.0	75.8	10.2	77.6	12.1
o	<u>taga</u>	136.3	17.2	101.8	9.3	89.8	13.9
	<u>tak^ha</u>	94.2	10.1	58.5	5.6	54.8	11.5
r	<u>ʌbʌ</u>	129.2	31.8	106.5	18.7	89.4	20.3
	<u>ʌp^hʌ</u>	86.0	23.3	71.8	4.0	73.6	8.9
a	<u>ibal</u>	162.0	41.8	114.5	31.6	84.2	36.4
	<u>ip^hal</u>	124.8	22.4	94.3	17.7	66.0	30.3
n	<u>idal</u>	158.2	50.1	114.5	11.5	80.4	34.4
	<u>it^hal</u>	123.2	57.3	81.8	12.0	70.0	24.2

Note. ^aMeasured vowels are underlined.

Table 2. Descriptive Statistics for English

	<i>N</i>	<i>mean</i>	<i>SD</i>	<i>SE</i> ^a	95% CI of mean	
					lower	upper
A	5	68.466	9.551	4.217	56.607	80.326
I	4	45.633	33.360	16.680	-7.451	98.717
K	5	28.040	14.431	6.453	10.121	45.958
total	14	47.504	25.783	6.890	32.617	62.391

Note. ^aSE stands for standard error of the mean.

Since Levene statistics showed that variance homogeneity was achieved in English data (with $F=3.389$, $p=.071$), one-way ANOVA was carried out. And the result shows that there is a significant difference between groups with $p=.029$ (as shown in <Table 3>).

Table 3. Analysis of Variance: English

	<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>p</i>
Inter-group	4105.401	2	2052.701	4.977	.029
Intra-group	4536.739	11	412.431		
sum	8642.140	13			

Since it was established that there was a significant difference among groups, post-hoc analyses using Scheffe and Bonferroni were also carried out to check specifically which groups have significant differences. <Table 4> shows post hoc analyses for English (S for Scheffe, B for Bonferroni).

Table 4. Post hoc Analyses for English

	<i>group (I)</i>	<i>group (J)</i>	<i>MD(I-J)</i>	<i>SE</i>	<i>p</i>	95% CI	
						lower	upper
S	A	I	22.833	13.623	.286	-15.613	61.280
		K	40.426*	12.844	.029	4.178	76.674
	I	A	-22.833	13.623	.286	-61.280	15.613
		K	17.593	13.623	.460	-20.853	56.040
B	K	A	-40.426*	12.844	.029	-76.674	-4.178
		I	-17.593	13.623	.460	-56.040	20.853
	A	I	22.833	13.623	.366	-15.584	61.251
		K	40.426*	12.844	.028	4.205	76.647
B	I	A	-22.833	13.623	.366	-61.251	15.584
		K	17.593	13.623	.669	-20.824	56.011
	K	A	-40.426*	12.844	.028	-76.647	-4.205
		I	-17.593	13.623	.669	-56.011	20.824

Note. * $<.05$

Group A shows significantly greater VLD than group K while group I did not show any significant difference with any other groups. In other words, the difference between vowels before voiced consonants and voiceless consonants in group A was much greater than that in group K while group A shows no difference with either group I or group K.

This result seems to suggest that the VLD is English-specific phenomenon, and as such, the more one is exposed to English, the greater the VLD is.

3.1.2. Korean data

Now we turn to Korean data. The descriptive statistics for Korean data are given in <Table 5>.

Table 5. Descriptive Statistics for Korean

	<i>N</i>	<i>mean</i>	<i>SD</i>	<i>SE</i>	95% CI of mean	
					lower	upper
A	5	39.591	5.027	2.248	33.348	45.833
I	4	31.733	5.682	2.841	22.690	40.776
K	5	18.903	13.415	5.999	2.246	35.560
total	14	29.957	12.420	3.319	22.786	37.128

Since the variance homogeneity was not achieved (with Levene statistics 5.833, $p=.019$), Welch's ANOVA was carried out instead of standard ANOVA. And the result shows that there is a significant difference in VLD among groups in Korean data as well (with Welch (F value) 5.767, $df_1=2$, $df_2=6.703$, and $p=.035$).

Again, since there was a significant difference among groups, to see which groups have significant differences, Dunnett T3 and Games-Howell post-hoc analyses were carried (see <Table 6>: D for Dunnett T3 and GH for Games-Howell).

Table 6. Post hoc Analyses for Korean

	<i>group p(I)</i>	<i>group (J)</i>	<i>MD (I-J)</i>	<i>SE</i>	<i>p</i>	95% CI	
						lower	upper
D	A	I	7.857	3.623	.182	-3.363	19.350
		K	20.687	6.406	.059	-.926	42.301
	I	A	-7.857	3.623	.182	-19.350	3.363
		K	12.830	6.638	.254	-8.815	34.475
GH	K	A	-20.687	6.406	.059	-42.301	.926
		I	-12.830	6.638	.254	-34.475	8.815
	A	I	7.857	3.623	.154	-3.191	18.907
		K	20.687	6.406	.050	-.011	41.387
GH	I	A	-7.857	3.623	.154	-18.907	3.191
		K	12.830	6.638	.215	-7.944	33.604
	K	A	-20.687	6.406	.050	-41.387	.011
		I	-12.830	6.638	.215	-33.604	7.944

The result in <Table 6> is kind of interesting in the sense that, according to Games-Howell, group A and group K show significant difference (with $p=.05$), while according to Dunnett T3, they show marginally significant difference (with $p=.059$). Considering both analyses, we could safely say that group A exhibit significantly greater degree of VLD than group K. And group I is not different from any other groups. This is consistent with what was found in English data.

Another interesting point is that statistically meaningful results were acquired without considering the speaking rate of each individual speaker.

3.1.3. Conclusion: big picture

There is a consistent pattern showing both in English and Korean data. There is a definite VLD in group A in both English and Korean language data: group A shows significantly bigger VLD in both languages compared to group K. Group I does not show any difference from any other groups. Pearson correlation coefficients between groups and VLD are $-.688$ ($p=0.007$) in English and $-.730$ ($p<0.003$) in Korean. This result indicates that the VLD is in the order of $A > I > K$: that is, the longer the exposure to English, the stronger the VLD.

3.2. Fine-Resolution Picture: t-test

As we have seen the big picture in which group *A* is different from group *K* in the VLD, the next legitimate question may be: is there any noticeable patterns of VLD in each group, not across the groups? Is the detailed analysis going to reveal more fine-resolution pictures? To answer this question, t-test of each word pair for each group was conducted.

Another justification for this micro-level t-test is due to the measuring criteria used for the study. As mentioned in the previous section of Measurement, for some words the measurement was taken not just for vowel section but also for previous and following consonant sections. As a result, the means for each vowel pair are in a very wide range, from 50 ms. to over 300 ms. For example, supposedly longer duration of the vowel [oU] in *robe* (about 190 to 230 ms. in three groups whose measurement included the [r] section as well as the target vowel) is considerably shorter than [al] before voiceless [s] in *price* (about 230 to 270 ms. whose measurement included the whole section of [pr] as well as the vowel itself.) When these wide range of measurements are pooled together, it might blur the details of what is actually happening.

However, those different measurement criteria will not be a problem when we compare each word pair individually in English and Korean.

The result of t-test for each group is presented in <Table 7> (group *A*), <Table 8> (group *I*), and <Table 9> (group *K*).

Table 7. t-test Results for Each Pair of Words for Group *A*

Word ^a	<i>M</i>	<i>SD</i>	<i>SEM</i> ^b	95% CI		<i>t</i>	<i>df</i>	<i>p</i> ^c
				lower	upper			
cab- cap	31.6	7.5	3.4	22.2	41.0	9.376	4	.001
league -leak	65.4	26.7	11.9	32.3	98.5	5.487	4	.005
prize- price	125.4	49.6	22.2	63.8	187.0	5.655	4	.005
rag- rack	81.0	12.2	5.5	65.8	96.2	14.83 8	4	.000
robe- rope	28.6	22.7	10.1	.5	56.7	2.821	4	.048
gugi- guk ^{hi}	46.6	20.4	9.1	21.3	71.9	5.116	4	.007
taga- tak ^{ha}	41.8	24.9	12.5	2.1	81.4	3.351	3	.044
Ab ^l - Ap ^h l	43.2	15.3	6.8	24.2	62.2	6.326	4	.003
ibal - ip ^h al	37.3	22.0	11.0	2.3	72.2	3.390	3	.043
idal - it ^h al	35.0	9.5	4.2	23.3	46.7	8.273	4	.001

Note. ^aMeasured vowels are underlined. ^bSEM stands for standard error of the mean. ^cp<.05 are in bold face.

Table 8. t-test Results for Each Pair of Words for Group *I*

Word ^a	<i>M</i>	<i>SD</i>	<i>SEM</i> ^b	95% CI		<i>t</i>	<i>df</i>	<i>p</i> ^c
				lower r	upper			
cab- cap	6.3	19.0	9.5	-24.0	36.5	.659	3	.557
league -leak	59.8	23.3	11.7	22.7	96.8	5.129	3	.014
prize- price	72.0	91.9	45.9	-74.2	218.2	1.568	3	.215
rag- rack	60.8	25.2	12.6	20.7	100.8	4.822	3	.017
robe- rope	29.0	24.3	12.2	-9.7	67.7	2.386	3	.097
gugi- guk ^{hi}	46.6	9.1	71.9	7.6	47.9	4.384	3	.022
taga- tak ^{ha}	41.8	12.5	81.4	31.7	53.8	13.003	3	.001
Ab ^l - Ap ^h l	43.2	6.8	62.2	1.3	68.2	3.302	3	.046
ibal - ip ^h al	37.3	11.0	72.2	-13.7	54.2	1.900	3	.154
idal - it ^h al	35.0	4.2	46.7	20.3	44.9	8.582	3	.003

Note. ^aMeasured vowels are underlined. ^bSEM stands for standard error of the mean. ^cp<.05 are in bold face.

Table 9. t-test Results for Each Pair of Words for Group *K*

Word ^a	<i>M</i>	<i>SD</i>	<i>SEM</i> ^b	95% CI		<i>t</i>	<i>df</i>	<i>p</i> ^c
				lower	upper			
cab- cap	9.2	3.2	2.8	1.5	16.9	3.307	4	.030
league -leak	58.0	27.9	12.5	23.4	92.6	4.651	4	.010
prize- price	53.0	54.2	24.2	-14.3	120.3	2.188	4	.094
rag- rack	34.4	35.5	15.9	-9.7	78.5	2.168	4	.096
robe- rope	-14.6	38.2	17.1	-62.1	32.9	-.854	4	.441
gugi- guk ^{hi}	15.8	16.0	7.2	-4.1	35.7	2.203	4	.092
taga- tak ^{ha}	35.0	14.4	6.4	17.1	52.9	5.440	3	.006
Ab ^l - Ap ^h l	15.8	23.7	10.6	-13.6	45.2	1.492	4	.210
ibal - ip ^h al	18.2	19.3	8.6	-5.7	42.1	2.114	3	.102
idal - it ^h al	10.4	18.8	8.4	-13.0	33.8	1.234	4	.285

A very clear difference among groups is observed in the VLD, which can be summarized as follows:

Group *A* shows a consistent and definite tendency for VLD for all ten pairs of words, both in English and Korean (in all 10 pairs).

Group *I* shows weak tendency for VLD in English (in two pairs out of five), and somewhat strong tendency in Korean (in four pairs out of five).

Group *K* shows weak tendency for VLD in English (in 2 pairs out of 5), and no tendency in Korean (in only one pair out of five).

This result can be summarized in <Table 10> with symbols.

Table 10. t-test Results for Each Pair of Words for Each Group

English					
	cab -cap	league -leak	prize -price	rag -rack	robe -rope
A	O	O	O	O	O
I	X	O	X	O	X
K	O	O	X	X	X

Korean					
	gugi -guk ^{hi}	taga -tak ^{ha}	AbA -Ap ^h A	ibal -ip ^h al	idal -it ^h al
A	O	O	O	O	O
I	O	O	O	X	O
K	X	O	X	X	X

Note. O represents the case in which $p < .05$, and X otherwise.

4. Discussion

4.1. First Question: Does the VLD exist in Korean?

This study started with two questions in mind. The first question was: is there VLD in Korean? Kluender *et al.* (1988) claims that VLD is “approximating a true phonetic universal” (p.153). However, from the results of current study, we can say that there is not a clear pattern of VLD in Korean language. As can be seen in <Table 10>, there is no VLD in Korean group (group *K*) except for one pair out of five. This result is contrary to Chen (1970), who reported the presence of VLD in Korean.

However, Chen (1970) had only a single subject. The study mentioned that the subject read each word six times, and the description of the recording process (“3 times in isolation, 3 times in alternation with its counterpart of the pair” (p.131)) seemed to suggest that the subject read the words by themselves, not in a sentence, and not in any randomized fashion. And the result was presented without any statistical analysis, presumably due to the lack of the enough sample size.

Kim (2011), who reported “the voicing dependent effect of the English vowels produced by native Korean speakers is lower than that of native English speakers” (p.15), did not state whether the results should be considered to show the non-existence of VLD in Korean.

Both Chen (1970) and Kim (2011) used isolated syllables without the consideration of the meaning of the syllables, and both reported their results in terms of the ratio of vowel length before voiceless consonants to vowel length before voiceless consonants.

The current study has five native Korean subjects, and all the words were randomized and embedded in natural and meaningful

sentences. Considering these experimental designs and statistical analyses, it can be assumed that the current study has more accurate picture of Korean language as far as the VLD is concerned. It seems Korean is not one of the languages exhibiting VLD.

One complication to that interpretation comes from the result of group *I*, which showed somewhat weaker, but still strong VLD in Korean data comparing to group *A*, while showing no sign of VLD in English data. It is not clear at this time how to interpret this seemingly perplexing result: they showed strong VLD in Korean data contrary to native Koreans (group *K*), while they show no sign of VLD in English data, which IS supposed to have very strong VLD.

However, considering the fact that the subjects in group *I* have spent at least 10 years in the U.S. under its education system, it would not be very logical to assume that what they showed in Korean language data is typical of native Korean when the native Koreans who spent less than 3 years in the U.S. (in group *K*) did not show any sign of VLD in Korean language data. Therefore, with these results, it can be said that Korean language does not have the VLD.

4.2. Second Question: Is the VLD transferred?

Is the trait of VLD transferred? The results seem to suggest that, indeed, yes, it is transferred from English to Korean, and from Korean to English as well. From the perspective of VLD, it seems group *A* does transfer the VLD from English to Korean. In other words, it seems to be the result of the “retention”(Jarvis & Odlin, 2000) of the characteristic of VLD in English when they speak Korean, a language which is not supposed to have the VLD.

Meanwhile, the absence of VLD in group *K* indicates that Koreans are having difficulty learning the VLD before voiced and voiceless consonants in English. In other words, it seems, for native Korean speakers, the absence of VLD in their mother tongue interferes with the acquisition of the appropriate degree of VLD in English.

Then, how can we interpret the result of group *I*? Group *I* exhibit the most peculiar picture in this study. This group’s result cannot be explained either in positive or negative transfer (another term for “interference”).

The clear patterns of positive or negative transfer of the trait of VLD shown in group *A* and *K* are in agreement with previous studies which claims phonetics and phonology are usually the systems in which transfer is more readily observable (Dulay *et al.*, 1982; Odlin, 2003).

A more interesting point from the current study is the age factor related with transfer. The current study is not trying to address on the validity of the so-called critical period hypothesis (Birdsong, 1999). However, the current study has clearly shown that the subjects who acquired English from the very beginning of their lives transfer the trait of the VLD into Korean while those who immigrated in their teens did not acquire the proper degree of VLD in English and also showed quite perplexing behavior in the pattern of VLD in Korean. Considering the time the group *A* spent their entire lives in the U.S. (more than 12 years from the birth), while group *I* spent about 10 years after they came to the U.S., this result strongly suggests that it takes not only time spent but also it has to be in earlier stages to acquire this phonetic trait. Flege *et al.*, (1999) also reported more nativelike pronunciation with Korean speakers who came to the U.S. at younger ages.

The result of group *K* implies that certain phonetic characteristics of a language like the VLD cannot be expected to be learned automatically. They have to be explained explicitly and consciously learned.

5. Conclusion

The current study examined the extent of VLD in three different groups whose exposure to English varied considerably. Carefully designed experiment was conducted to elicit a vowel and a voiced and a voiceless consonant combination in English and Korean.

The results show that VLD does not exist in Korean for native Korean speakers. Native Korean speakers do not exhibit any VLD in English either. The absence of VLD in Korean for native Koreans is not agreement with Chen (1970), whose study is quoted as the evidence of the existence of VLD in Korean (Kluender *et al.*, 1988:153).

Native Americans who were born in the U.S. exhibit strong degree of VLD both in English and Korean, thus indicating that the trait of VLD transferred from English to Korean language.

Immigrants, who moved to the U.S. in their early teens, do not show strong VLD in English, while showing somewhat strong degree of VLD in Korean. This group's results show that the phonetic trait of VLD has to be acquired in earlier stages of life to be mastered naturally.

Also, the current study shows that certain phonetic characteristics of a language cannot be expected to be learned just by spending time in the environment where the language is spoken. They have to be clearly pointed out so that L2 learners can learn them properly.

References

- Birdsong, D. (1999). Introduction: Whys and why not for the critical period hypothesis in second language acquisition. In D. Birdsong (Ed.), *Second language acquisition and the critical period hypothesis* (pp. 1-22). Mahwah: Lawrence Erlbaum Associates.
- Boersma, P., & Weenink, D. (2015). Praat: Doing phonetics by computer. Retrieved from <http://www.fon.hum.uva.nl/praat/> on March 31, 2017.
- Chen, M. (1970). Vowel length variation as a function of the voicing of the consonant environment. *Phonetica*, 22(3), 129-159.
- Dulay, H., Burt, M., & Krashen, S. (1982). *Language two*. New York: Oxford University Press.
- Fischer-Jørgensen, E. (1964). Sound duration and place of articulation. *Zeitschrift für Phonetik, Sprachwissenschaft und Kommunikationsforschung*, 17, 175-208.
- Flege, J., Yeni-Komshian, G., & Liu, S. (1999). Age constraints on second-language acquisition. *Journal of Memory and Language*, 41(1), 78-104.
- Fowler, C. (1992). Vowel duration and closure duration in voiced and unvoiced stops: There are no contrast effects here. *Journal of Phonetics*, 20(1), 143-165.
- House, A. (1961). On vowel duration in English. *The Journal of the Acoustical Society of America*, 33(9), 1174-1178.
- House, A., & Fairbanks, G. (1953). The influence of consonantal environment upon the secondary acoustical characteristics of vowels. *The Journal of the Acoustical Society of America*, 25, 105-113.
- Jarvis, S., & Odlin, T. (2000). Morphological type, spatial reference, and language transfer. *Studies in Second Language Acquisition*, 22(4), 535-556.
- Javkin, H. (1976). The perceptual basis of vowel duration differences associated with the voiced/voiceless distinction. *Report of the Phonology Laboratory*, 1, 78-92.
- Kim, J.-E. (2011). A study on the correlation between English word-final stop and vowel duration produced by speakers of Korean. *Phonetics and Speech Science*, 3(1), 15-22. (김지은 (2011). 한국인 영어 학습자의 어말 폐쇄음가 선행 모음 길이의 상관관계 연구. *발소리와 음성과학*, 3(1), 15-22.)
- Kluender, K., Diehl, R., & Wright, B. (1988). Vowel-length differences before voiced and voiceless consonants: An auditory explanation. *Journal of Phonetics*, 16(2), 153-169.
- Ladefoged, P. (2007). *A course in phonetics* (5th edition). Boston: Thomson Wadsworth.
- Lisker, L. (1974). On "explaining" vowel duration variation. *Glossa*, 8(2), 233-246.
- Maddieson, I., & Gandour, J. (1975). Vowel length before stops of contrasting series. *The Journal of the Acoustical Society of America*, 58(S1), S61.
- Odlin, T. (1989). *Language transfer* (1st edition). Cambridge: Cambridge University Press.
- Odlin, T. (2003). Cross-linguistic influence. In C. Doughty & M. Long (Eds.), *The handbook of second language acquisition* (pp. 436-486). Oxford, UK: Blackwell Publishing.
- Peterson, G., & Lehiste, I. (1960). Duration of syllable nuclei in English. *The Journal of the Acoustical Society of America*, 32(6), 693-703.
- Sharf, D. (1962). Duration of post-stress intervocalic stops and preceding vowels. *Language and Speech*, 5(1), 26-30.
- Slis, I., & Cohen, A. (1969). On the complex regulating the voiced-voiceless distinction II. *Language and Speech*, 12, 137-155.

• Seung-Jae Moon

Department of English Language and Literature
Ajou University
206 Worldcup-ro, Yeongtong-Gu
Suwon 16499, Korea
Tel: 031-219-2827
Email: moon@ajou.ac.kr
Fields of interest: Phonetics