

THE PRODUCTION OF “NEW” AND “SIMILAR” PHONES IN A SECOND LANGUAGE

Hyeon-zoo Kim

*Department of French language & literature of Dankook University, Seoul, South Korea
Institut de phonétique de Strasbourg - USHS, Strasbourg, France*

ABSTRACT

Acoustic measurements were made of the voice onset time (VOT) and vowels in French and Korean words spoken by native Korean subjects who were highly experienced in French, and by native French subjects. The speech of monolingual subjects was also examined to estimate the phonetic norms of French and Korean. A series of experiments is presented, in which identical stimuli are used to examine similar cue-trading relations in the perception of voicing contrast in word stops in Korean and French. Do Koreans who speak French use the Korean system when uttering French phonemes? Or are they mimicking the French system in the stressed intervocalic position?

Predicted cross-linguistic differences are found in the basis category boundary and in the case of cue trading between VOT and aspiration. The results are discussed in terms of the hypothesis that adult learners of a second language may establish new phonetic categories for phonetic segments not found in the native language.

1. INTRODUCTION

At first glance the acquisition of French [p,t,k] and [b,d,g] should hardly present a problem for Korean speakers. These stops also exist in French and are contrasted in both languages with the phonological feature +/- [voice] (or, less often, +/- [tense]) [2. 6. 11. 16. 17]. But /b,d,g/ don't exist in Korean. Wever [p,t,k] of Korean is usually voiced in intervocalic position [12. 13.14.15].

However, the phonological similarity covers a number of articulatory and acoustic differences in the patterns of temporal implementation.

While voicing is usually present in French [b,d,g] (except in contexts of assimilation), in Korean it occurs only in intervocalic position with any frequency.

2. PRELIMINARY

This is a comparative study of the production of French and Korean consonants plosives used in continuous speech, using experimental analysis.

The Korean consonant system comprises three series of unvoiced plosives.

	bilabials	alveodentals	palatals	velars
lenis	p	t	c	k
aspirated	p ^h	t ^h	c ^h	k ^h
glottalized	p ^ʔ	t ^ʔ	c ^ʔ	k ^ʔ

The French consonantal system comprises two series of plosives which differ according to voicing (either voiced or unvoiced) and according to degree of tension (either fortis or lenis).

	bilabials	alveodentals	velars
unvoiced p		t	k (fortis)
voiced	b	d	g (lenis)

We have chosen to study the identification of VOT (Voice Onset Time) values to distinguish between the French voiceless stops [p,t,k] and the Korean stops [p,t,k]. The analysis was carried out on native Korean speakers who were bilingual compared with native French speakers.

First, the study aimed, at determining the differences between the production of the voiceless stops in French and Korean using the VOT values and, secondly, an analysis by native Korean speakers of French. The research reported was concerned with voiceless stops of French and Korean ; the experimental analyses of phonological models were used to achieve the required analysis.

The main question addressed here is, how can one explain the differences in behaviour for apparently the same elements that are in a similar context? The answer to this question is discussed in relation to the notion of the phonetic context and its influences. An additional theoretical notion should also be taken into account; that of a system, a decisive factor that cannot be dissociated from the notion of “phonological constraints.”

A series of experiments are presented, in which identical stimuli are used to examine similar cue-trading relations in the perception of the voicing contrast in word stops in Korean and French.

“New” L2 (second language) phones have no counterpart in L1 and so, by definition, differ acoustically from phones found in L1 (native language). “Similar” L2 phones, on the other hand, differ systematically from an easily identifiable counterpart in L1.

Predicted cross-linguistic differences are found in the basis category boundary and in the case of cue trading between VOT and aspiration.

2.1. Methods

2.1.1. Talkers. The aim of this study is to examine French and Korean for differences between acoustic temporal cues in the production of French plosives produced by French speakers, of the same French plosives produced by French-speaking Koreans, and Korean plosives produced by Korean speakers.

Three groups of talkers differing in language background and experience were recruited from a university community for the present study.

The native French-speaking group, designated group NF, consisted of six French males.

There was one group of native Korean speakers (six Korean males) who spoke French as a second language, all men from the Seoul. The talkers in one group, designated group NFK, consisted of undergraduate students.

A more experienced group of native Korean speakers, designated group NK, consisted of six Koreans.

The native French and the native Koreans differed little in mean age (31 vs 25 years). The native French were students at

the University of Strasbourg. The native French-speaking Koreans did not begin learning French until they were adults. The subjects in this group were native speakers of Korea who learned French as a second language. The learners indicated that they were first exposed massively to French when they started their university studies in Seoul between the ages of 18 and 19.

2.1.2. Materials and procedures. The following four sets of phrases (two sets in French and two sets in Korean for two experiments) were used in counterbalanced order to elicit production of the French syllables by the native speakers of French and the native French-speaking Koreans, and the Korean syllables by the native Koreans.

Recordings were carried out in a sound proof room at the Phonetics Institute of Strasbourg in France.

For the first experiment, the corpus is based on 36 short Korean sentences and 27 short French sentences. The sentences embedded the target VCV words, where V1 is /a/ and V2 is /i, a or u/.

For the second experiment, native (Group 1: Control Group) and non-native (Group 2: Experiment Speakers Group) produced minimally paired /VCV/ syllabic structures in final syllable of phrases. Each of the test words occurred three times on the French and Korean lists. A total of 48 phrases in Korean and 27 phrases in French were used.

3. EXPERIMENT I

The subjects, made identifications of medial stops as /p,t,k/ in French or /p,t,k,p^h,t^h,k^h,p^ʰ,t^ʰ,k^ʰ/ in Korean. In the first experiment, VOT was measured in the French phrases of carrier sentences (with comparable syllabic structures) spoken by 3 native French and by 3 French-speaking Koreans who had learned French and in the Korean phrases spoken by 3 native Koreans. Each speaker uttered a series of words in carrier sentences (with comparable syllabic structures) at a normal self-selected speaking rate. The study aimed first at determining the differences between the production of the voiceless stops and the differences in the degree of palatalization (revealed by VOT) for the two languages using the VOT values, and second, at analysing the characteristics of the French consonants produced by French-speaking Koreans.

Results discussed mean VOT values for French and Korean voiceless stops medial position in the phrases. The value shown here averaged across the /a/ context. VOT, we have noticed, is the principal cue in distinguishing the three Korean plosives, as both absolute and relative VOT values for aspirates are different from those of the non-aspirates.

In Korean, VOT is, therefore, among the indicators that permit us to distinguish the three categories of Korean voiceless stops, which is very important the aspirated consonants and the glottalized consonants for utterances in medial position of the phrases.

As expected, the monolingual French speakers' VOT is superior to the voiceless glottal stops of VOT of the French-speaking Koreans.

Also, as expected, the French-speaking Koreans produced the French plosives with shorter VOT values than the native French, as their VOT correspond to values comparable with those of the glottal plosives for Korean.

The duration of Korean plosives permitted us to distinguish between the three categories, i.e. aspirates, glottals and lenis in an intervocalic context.

Total consonant duration in Korean allows distinguishing aspirates, from glottals and lenis consonants, when flanked by vowels; the voiced counterparts are always shorter.

With regards to the duration of the preceding vowel, we recognized that this measure is not an indicator sufficient to distinguish the voiceless plosives of French-speaking Koreans, even less in the case of the aspirated plosives and of the glottalized plosives. The duration of the preceding vowel is clearly shorter before the lenis plosive velars in comparison with the lenis plosive bilabials and the lenis plosive alveodentals.

In the case of the French stops of the native French, (as well as in the case of the French-speaking Koreans), the duration of the preceding vowel, being practically identical, does not constitute an indication of differentiation.

Table 1. VOT, duration of consonant closure and duration of preceding vowel [the three groups : NF (native French), NFK (French-speaking Koreans) and NK (native Koreans)]

	VOT		
	Bilabials	Alveodentals	Velars
Lenis (NK)	0	0	0
Aspirated (NK)	38	49	36
Glottalized (NK)	14	14	21
Unvoiced (NF)	17	27	31
Unvoiced (NFK)	20	16	30
	Consonants		
	Bilabials	Alveodentals	Velars
Lenis (NK)	53	46	48
Aspirated (NK)	114	123	125
Glottalized (NK)	140	109	132
Unvoiced (NF)	109	114	108
Unvoiced (NFK)	189	137	171
	Preceding vowels		
	Bilabials	Alveodentals	Velars
Lenis (NK)	44	28	93
Aspirated (NK)	101	68	95
Glottalized (NK)	93	108	97
Unvoiced (NF)	84	103	84
Unvoiced (NFK)	92	116	105

4. EXPERIMENT II

For the second experiment, the subjects, made identifications of medial stops as [p,t,k] in French or [p,t,c,k,p^h,t^h,c^h,k^h,p^ʰ,t^ʰ,c^ʰ,k^ʰ] in Korean. In this experiment, we include palatal Koreans [c^h,c^ʰ], because in the first experiment, the French speakers palatalized the plosives in the /i/ and /u/ contexts. Therefore we compare the French stops palatalizing and Korean palatals

In French and in many languages, the duration of the vowel in front of the voiced consonants is longer than in front of the unvoiced consonants (10. 18). However this indicator appears not to be applicable in any languages (12. 20). We

studied this indicator, but it did not bring validity concerning the nature of the plosives Koreans (13. 14. 15). Even though, for this search, we decided to examine the duration of the subsequent vowel. Therefore, we measured the three indexes : VOT, durations of consonant closure and subsequent vowel.

Three native French (NF), three French-speaking Koreans (NFK) and three native Koreans (NK) produced minimally paired /VCV/ syllabic structures in final syllables of the phrases. Each of the test words occurred three times on the French and Korean lists.

Table 1. VOT, duration of consonant closure and duration of subsequent vowel [the three groups : NF (native French), NFK (French-speaking Koreans) and NK (native Koreans)]

	VOT			
	Bila.	Alveo.	pala.	Velars
Lenis (NK)	0	0	0	0
Aspirated (NK)	60	52	69	88
Glottalized (NK)	14	9	34	18
Unvoiced (NF)	15	23	-	33
Unvoiced (NFK)	11	10	-	19
	Consonants			
	Bila.	Alveo.	pala.	Velars
Lenis (NK)	57	48	75	62
Aspirated (NK)	169	163	187	175
Glottalized (NK)	165	152	178	157
Unvoiced (NF)	146	155	-	145
Unvoiced (NFK)	198	187	-	192
	Subsequent Vowels			
	Bila.	Alveo.	pala.	Velars
Lenis (NK)	134	134	133	162
Aspirated (NK)	100	114	118	85
Glottalized (NK)	135	121	128	123
Unvoiced (NF)	106	94	-	100
Unvoiced (NFK)	118	96	-	99

Table II presents the VOT of stops produced by talkers in the three speaker groups. The VOT of alveodentals was somewhat shorter for the another stops (bilabiales, palatales, velars) in Korean. The VOT is the indicator that permit us to distinguish the three categories of Korean voiceless stops, which is very important in making a distinction between the aspirated consonants and the glottalized for utterances in final position of the phrases.

On the contrary, VOT is significantly longer for the aspirated sounds in Korea. The VOT of the native French speaker is superior to the voiceless glottal stops of VOT of the French-speaking Koreans.

As expected, the French-speaking Koreans produced the French plosives with shorter, VOT values than the native French, as their VOT correspond to values comparable with those of the glottal plosive for Korean.

The duration of Korean plosives aspiration is clearly longer than the plosives glottals and lenis consonants, because of the intensity of their aspiration. In Korean, the duration of

consonants is, therefore, among the indicators that permit us to distinguish the three categories of Korean voiceless stops. The duration of the lenis consonants is significantly shorter than the other aspirates and the glottals of Koreans and the plosives of French.

French speaking Koreans have significantly longer closure values than French speakers. Moreover, the French speaking Koreans do not seem to use any of the Korean categories, lenis, aspirated ou glottalized. We seem to be dealing with a new category used by the French-speaking Koreans!

As concerns the subsequent vowel, it was noticed that this measure was significant in differentiating categories: lenis, aspirates, glottals. The duration of vocalization varies depending on the function: from the our observation, in Korean, the duration of the vowel succeeding the aspirated consonants is much shorter than the duration of the vowel succeeding the lenis or glottalized consonants. Also, the vowels succeeding the lenis [p,t,k] Koreans was longer in duration than the another vowels of Koreans and of French. In the French-speaking Koreans, the duration of the vowels is similar to the duration of the vowels of French.

5. GENERAL DISCUSSION

Previous studies have shown that adults who learn English as a second language in adulthood often do not produce a fully English-like distinction between voiced and voiceless stops in the final position of English word (5). Also, French-speaking Koreans do not produce a French-like distinction between voiced and voiceless stops in the position intervocalic in French (12. 13). This is because the voiced stop does not exist in Korean. Therefore the Korean subjects do not recognize them when they speak French. For many subjects examined in previous studies, this might be attributed to the lack of sufficient L2 experience. For others, it might be attributed to the interlingual identification of L1 and L2 stops.

This study will be very useful for comparing our results with any other recent research on VOT especially in FLEGE's works. This experiment yielded results that were very much the same as those obtained in his experiments. Both the native French, the native Koreans and the French-speaking Koreans produced French and Korean plosives.

The French-speaking Koreans had larger VOT differences in the sentence condition, where the French and Korean sentences were produced in alternation.

These changes in the production of VOT of the bilinguals, are more important than the results obtained by CARAMAZZA for French-English bilinguals . This is also a very strong tendency, as in the research of WILLIAMS (19), for the voiced /b/ of bilinguals in English. CARAMAZZA & YONIKOMSHIAN (1) have concluded that VOT is a sufficient phonological cue for the distinction of the homogenic stop consonant of French spoken in Paris. They have also proposed an explanation for the observed differences between French and Canadian French based on a linguistic change hypothesis.

FLEGE (7), on the other hand, hypothesized that complete separation of sounds in the L1 and L2 phonetic inventories is possible, at least for early learners. Previous studies have shown that many adult L2 learners produce English /p, t, k/ with significantly shorter VOT values than English monolinguals, but with significantly longer VOT values than that of monolingual native speakers of the learners L1 (5).

According to FLEGE & EEFTING (7), it appears that proficient Dutch speakers of English produced Dutch /t/ with shorter VOT values than non-proficient subjects, suggesting they formed a new category for English /t/. This finding corroborates our results. As mentioned earlier, VOT is the strongest cue in differentiating Korean plosives. VOT in French is superior to that for the glottal class in Korean. For French-speaking Koreans, VOT values are not high and correspond to those obtained for French speakers, as they also correspond to those measured for glottalized Korean plosives. However, VOT for the glottals in Korean are shorter than that for French spoken by Koreans. The findings of Flege (1987) presented here indicate that adults are capable of learning to produce new phones in an L2 and of modifying their previously established patterns of articulation when producing similar L2 phones.

6. CONCLUSION

In a palatalizing context (+i, j), Korean and French plosives were analyzed according to three variables: VOT, duration of consonant and duration of preceding vowel or duration of subsequent vowel. Moreover the [a] vowel influences least surrounding consonants in contrast with the [i] vowel which tends to palatalize consonants, especially in French.

In French, there are no unvoiced consonants but palatalization occurs; whereas in Korean, there are palatals, but no palatalization occurs.

Results point to systematic differences in Korean and French as to the amplitude and palatalization degree. Why do elements in a similar context behave differently?

We can conclude that French-speaking Koreans realized another form for French /p,t,k/. We are dealing here with a new category for French /p,t,k/. Because VOT values of French voiceless stops /p,t,k/ produced by French-speaking Koreans are very similar to VOT values by native French. But it seems, under examination of consonant duration, that neither Korean glottalized consonants nor French voiceless stops are used by French-speaking Koreans and, with regard to VOT, they are not used for aspirated Korean consonants. This may correspond to a new category of voiceless plosives (for French-speaking Koreans).

These results are interpreted to mean that individuals who learn L2 later in life are also able to establish phonetic categories for sounds in the L2 that differ acoustically from corresponding sounds in the native language. The results strongly suggest that the late L2 learners produced /p,t,k/ with slightly longer VOT values in French than Korean glottalized plosive and shorter VOT values in French than Korean aspirated plosive by applying different realization rules to a single phonetic category.

In summary, this study indicated that adults are capable of learning to produce new phones in an L2, and of modifying their previously established patterns of articulation when producing similar L2 phones.

It appears that the mechanism of equivalence classification leads them to identify acoustically different phones in L1 and L2 as belonging to the same category. This may ultimately prevent them from producing similar but new phones authentically.

In conclusion, French-speaking Koreans seem to use the glottalized category to obtain comparable French VOT values, and closure duration for French-speaking Koreans is

significantly longer than all other categories, whether Korean or French. We are dealing with a new category. Speakers, in general, use native language phonological constraints as a reference when learning a second language.

REFERENCES

- [1] Caramazza, A. and Yeni-Komshian, G.H. 1974. Voice onset time in two French dialects. *Journal of Phonetics*, 2. 125-148.
- [2] Debrock, M. 1977. An acoustic correlate force of articulation. *Journal of Phonetics*. 61-80.
- [3] Docherty, G.J. 1991. The timing of voicing in British English obstruents. *Firius*. Dordrecht.
- [4] Flege, J.E. 1987. The production of "new" and "similar" phones in a foreign language: evidence for the effect of equivalence classification. *Journal of Phonetics*, 15. 47-65.
- [5] Flege, J.E. and Port, R. 1981. Cross-language phonetic interference: Arabic to English. *Language and Speech*, 24. 125-146.
- [6] Flege, J.E. and Brown, W.S. 1982. The voicing contrast between English /p/ and /b/ as a function of stress and position-in-utterance. *J. Phonet.* 10, 335-345.
- [7] Flege, J.E. and Eefting, W. 1988. Imitation of a VOT continuum by native speakers of English and Spanish: Evidence for phonetic category formation. *Journal Acoust. Soc. Am.*, 83. 729-740.
- [8] Flege, J.E. and Schmidt, A.M. 1995. Native speakers of Spanish show rate-dependent processing of English stop consonants. *Phonetica*, 52. 90-111.
- [9] Flege, J.E., Schmidt, A.M. and Wharton, G. 1996. Age of learning affects rate-dependent processing of stops in a second language. *Phonetica*, 53. 143-161.
- [10] House A.S. (1961), "On vowel duration in English," *Journal Acoust. Soc. Am.*, N° 33, pp. 1174-1178.
- [11] Keating, P.A. 1984. Phonetic and phonological representation of stop consonant voicing. *Language* 60, 286-319.
- [12] Kim, H.Z. 1994. Contribution à une étude comparative des occlusives du coréen et du français. *Travaux Ins. Pho. Strasbourg*. 24, 39-89.
- [13] Kim, H.Z. 1995. French and Korean Plosives: a Comparative Analysis. *International Congress of Phonetic Sciences* 95, 4. 176-179.
- [14] Kim, H.Z. 1996. Quelques aspects acoustiques de la production des occlusives du coréen et du français. *Journée d'étude sur la Parole* 96. 21, 159-162.
- [15] Kim, H.Z. 1998. Production de phones "Nouveaux" et "Similaires" en L2. *Journée d'étude sur la Parole* 98. 22, 79-82.
- [16] Lisker, L. 1978. On buzzing the English /b/. *Haskins Lab. Rep. Speech Res.*, SR 65, 1-32.
- [17] Malécot, A. 1970. The lenis-forcis opposition: its physiological parameters. *J. acoust. Soc. Am.* 47, 1588-1592.
- [18] Thorsen O.M. 1966. "Voice assimilation of stop consonants and fricatives in French and its relation to sound duration and intraoral air-pressure," *ARIPUC*, 1. 67-76.
- [19] William, S.L. 1977. The voicing contrast in Spanish. *Journal of Phonetics*, 5. 169-184.
- [20] Zimmermann S.A. & Sapon S.M. 1958. Note on vowel duration seen cross linguistically. *Journal Acoust. Soc. Am.*, 30, 2. 152-153.