〔駒沢女子短期大学　研究紀要　第24号　P.79～81　1991〕

子音環境における母音の長さの変化

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Vowel Length Variation in the Consonantal Environment

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1. Objective

This paper has two main purposes; (1) To see whether the fact that in English vowels are generally longer before voiced consonants than before voiceless consonants applies to the vowels of Japanese and Korean. If it does, we might, tentatively, be able to conclude that this kind of durational differential is (a) primarily conditioned by an inherent physiological feature of articulation, rather than (b) a matter of linguistic structure, that is, a learned language-specific speech habit characteristic of the phonological system of a language — here, English[1]. (2) To see whether the claim that the influence of preceding consonants on the duration of vowels following them is negligible[2] is true of Japanese and Korean.

2. Experiment

The word-lists of each of the two languages consist of minimal pairs.

In the Japanese minimal pairs, the consonants /k/ and /b/ were chosen because they are phonologically stable in the Japanese language. (Such consonants as /t/, /g/, /h/ and /s/ undergo some phonological changes under some environments.)

In the Korean minimal pairs, the consonants /p^h/ (strongly-aspirated p), /p'/ (slightly-aspirated p) and /m/ were chosen because the otehr combinations produce some phonologically absent pairs.

In order for the experimental factors to remain equal, good care was taken to assure identical prosodic patterns — mainly pitch and rhythm — for each member of the pairs.

Recordings, 80 spectrograms and measurements were made of the two languages.

3. Results

The data show that in the two languages studied, a vowel is longer before a voiced consonant than before an unvoiced one.

The results also show that a vowel is invariably longer after a voiced consonant than after an unvoiced one.

The influence that the preceding consonant exercises on the following vowel is as great as the one that the following consonant has on the preceding vowel in Japanese.

In Korean, the following consonant has shown greater influence than the preceding consonant on the vowel.

Within the four possible environments, i.e. (1) VlessC_VlessC, (2) VlessC_VdC, (3) VdC_VlessC, and (4) VdC_VdC, the vowel in the VlessC_VlessC environment was the shortest, and the one in the VdC_VdC environment was the longest in the two languages.

JAPANESE

Table 1

	k_ki	k_bi	b_bi	b_ki
a	128 msec	168 msec	192 msec	168 msec
i	104	144	160	136
u	128	120	160	128
e	112	136	168	112
o	104	120	168	136
average	115 msec	138 msec	170 msec	136 msec
ratio	1	: (1. 2	1. 48	1. 18)

Table 2

	k_ka	k_ba	b_ba	b_ka
a	120 msec	160 msec	152 msec	144 msec
i	88	104	136	88
u	80	104	120	104
e	80	120	136	104
o	88	88	120	120
average	91 msec	115 msec	133 msec	112 msec
ratio	1	: (1. 26	1. 46	1. 23)

KOREAN

Table 3

	p^h_p′	p^h_m	m_m	m_p′
a	96 msec	152 msec	192 msec	96 msec
i	112	144	120	104
u	88	96	104	96
e	88	136	136	136
o	88	144	152	104
average	94 msec	134 msec	141 msec	107 msec
ratio	1	: (1. 43	1. 5	1. 14)

Table 4

	p^h_p^hul	p^h_mul	m_mul	m_p^hul
a	88 msec	184 msec	192 msec	168 msec
i	80	128	184	144
u	88	144	224	144
e	104	184	232	160
o	112	120	200	144
average	94 msec	152 msec	206 msec	152 msec
ratio	1	: (1. 62	2. 19	1. 62)

Vowel + Vless Consonant vs. *Vowel* + Vd Consonant

JAPANESE

Table 5

		ratio
k_ki : k_bi	115 msec : 138 msec	1 : 1. 20
k_ka : k_ba	91 : 115	1 : 1. 26
b_ki : b_bi	136 : 170	1 : 1. 25
b_ka : b_ba	112 : 133	1 : 1. 19
	average⟶	1 : 1. 23

KOREAN

Table 6

		ratio
p^h_p′ : p^h_m	94 msec : 134 msec	1 : 1. 43
p^h_p^hul : p^h_mul	94 : 152	1 : 1. 62
m_p′ : m_m	107 : 141	1 : 1. 32
m_p^hul : m_mul	152 : 206	1 : 1. 36
	average⟶	1 : 1. 43

Vless Consonant + *Vowel* vs. Vd Consonant + *Vowel*

JAPANESE

Table 7

		ratio
k_ki : b_ki	115 msec : 136 msec	1 : 1.18
k_ka : b_ki	91 : 112	1 : 1.23
k_bi : b_bi	138 : 170	1 : 1.23
k_ba : b_ba	115 : 133	1 : 1.16
	average⟶	1 : 1.20

KOREAN

Table 8

		ratio
p^h_p′ : m_p′	94 msec : 107 msec	1 : 1.14
p^h_p^hul : m_p^hul	94 : 152	1 : 1.62
p^h_m : m_m	134 : 141	1 : 1.05
p^h_mul : m_mul	152 : 206	1 : 1.36
	average⟶	1 : 1.29

4. Conclusion

Many researchers have offered various explanations. None seem to be able to give satisfactory explanations for vowel length variation in the consonantal environment. Matthew Chen's closure transition theory seems to be insufficient in explaining vowel length variability in the fricative environment[3].

Raymond Kent in *Models of Speech Production* has shown that (a) an articulatory adjustment for one phonetic segment is anticipated during an earlier segment, (b) similar effects operate in the opposite direction so that an articulatory adjustment for one segment may be carried over to a later segment.

(a) C V C ↑_| or C V C V ↑__| or C V C V ↑____| etc.

(b) C V C |_↑ etc.

As for the following voiceless consonant in this case, that the vocal cord must stop its vibration may have some effect on shortening the preceding vowel. The continual vocal vibration of the voiced consonant might have some prolonging effect on the following vowel.

FOOTNOTES

1. Chen, Matthew. "Vowel Length Variation as a Function of the Voicing of the Consonant Environment," *Phonetics*, XXII (1970), p. 130.
2. Lehiste, Ilse. "Suprasegmental Features of Speech," *Contemporary Issues in Experimental Phonetics*, chap. vii, p. 227.
3. Ok*a*su—112 msec, ok*a*zu—168 msec. (1:1.5) Sas*a*mi—112 msec, saz*a*mi—144 msec. (1: 1.31)

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