

ON THE PHONETIC PERCEPTION OF PLOSIVES

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1. Introduction

The main purpose of this paper is to investigate the perceptual tendency of Koreans and Japanese to identify plosive consonants. This is only a preliminary result of one of the series of perception tests which have been conducted in Japan and Korea since 1978 with a view to finding out perceptual difference, if any, between Koreans and Japanese with regard to various phonetic properties, including word-initial and syllable-final consonants, intervocalic consonant clusters and vocalic sounds, etc. The present paper, however, is confined only to the perceptual tendency of Japanese listeners to identify syllable-final and intervocalic plosive consonants.

2. Purpose

Japanese people are known to have serious difficulty in perceiving and articulating syllable-final plosives occurring in (C)VC and (C)VCCV structures, but it is not really clear yet how serious or widespread this tendency is among Japanese speakers. The purpose of this paper, therefore, is to find out the perceptual tendency and ability of Japanese to identify the syllable-final p, t, k and intervocalic clusters pt, pk, tk,

kp, kt, kk.

3. Method

The perception test has taken the form of asking informants to write down on the test sheet what they hear while listening to the prerecorded material, using either the Japanese syllables or phonetic symbols. Every test word was repeated twice in succession with a short break in between. The perception test was conducted twice on the same day with the same informants to see if any difference would emerge.

4. Test Material

The phonetic material used for the perception test is as follows:

- A. 1)pak, 2)pat, 3)pap, 4)pik, 5)pit, 6)pip
- B. 1)bap, 2)bat, 3)bak, 4)bit, 5)bip, 6)bik
- C. 1)bakka, 2)batka, 3)bapka,
4)bapta, 5)bakpa, 6)bakta

In the material given above, p stands for aspirated plosive [p^h] as in English "pay", "pearl" and Korean "pal" (arm), "pul" (grass), and b for slightly aspirated and devoiced [b] as in Korean "bal" (foot), "bul" (fire). In A and B the syllable-final p, t, k represent plosives without plosion. Similarly, the initial element of each of the plosive clusters material in C which comprise 6 two-syllable words was pronounced as naturally as possible in a citation form with a falling intonation, i.e., with high pitch on the first syllable and low pitch on the second one. When recording the test material, special care was taken to keep the stress and length given to the two syllables as constant as possible. The test

material was meant to be artificial although some of the test words actually do occur in Korean as lexical items.

5. Recording

The test words were recorded on a reel tape in the recording studio of the Faculty of Medicine, University of Tokyo with the writer as speaker. Recording facilities used for the recording are as follows:

- 1) Teak R-740 Professional Tape Teck
- 2) Sony ECM-54 Electret Condenser Microphone
- 3) Sony SLH 275 BL (Tape)

I am grateful to Mr. Nagai, a technician at the Institute of Logopedics and Phoniatics, University of Tokyo and to Prof. Sawashima and Hirose of the Institute for their generous help and cooperation.

6. Informants

The seven Japanese informants, 6 men and one woman, all lived in Tokyo for more than 19 years at the time of the test, and they all had good educational background and were conversant with phonetics and linguistics. Furthermore, they all spoke English and had some knowledge of one or more foreign language(s) beside English. In other words they were highly qualified elites of Japanese society with a good phonetic/linguistic insight. As will be explained later, the educational background of informants may be significant in interpreting the results of a perception test.

7. Results

The results of the two perception tests are shown

in tabulated form in Table 1 where the capital letters like H, R, W etc. stand for the informants. In the table 1 entitled "Individual Perceptual Errors of Syllable-final Plosives", empty space represents correct judgement, the symbol \emptyset silence or no response, and p, t, \int stand for perceptual errors. The numeral in brackets written next to phonetic symbols indicates the number of errors made by the informants. For instance, the notation p(1)/ \emptyset (1) found in column k to the left of W means that the informant W misheard the syllable-final k as p on one occasion and as glottal stop on another.

The table 2, which is a condensed form based on Table 1, shows the total number of mistakes made for each plosive sound in Test 1 and 2. Thus, one can see in the Table 2 that p was misjudged as silence four times in

Table 1. Individual Perceptual Errors of Plosives

TEST 1				TEST 2		
p	t	k	Informants	p	t	k
		p(1)/t(1)	H(1)			t(2)
		p(1)/t(1)	R(2)		p(1)	t(2)
	\emptyset (1)	p(1)/ \emptyset (1)	W(3)	x	x	x
			U(4)			
\emptyset (3)	p(1)/ \emptyset (3)	\emptyset (4)	I(5)	\emptyset (2)	p(1)/ \emptyset (3)	p(2)/ \emptyset (2)
	\int (3)	\int (2)	K(6)	\int (1)	\int (1)	\int (2)
\emptyset (1)	\emptyset (2)	t(2)	N(7)			

Test 1 and three times in Test 2, giving us a total of 7 in all. It is to be noted that the glottal stop, which was dealt with as an independent element in Table 1 has been incorporated into silence because glottal stop, although phonetically similar to a plosive sound, can not yet be happily assigned to any of the three plosives.

Table 2. Total Perceptual Errors of Plosives

	p	t	k	
Test 1	ø(4)	ø(9)/p(1)	ø(7)/p(3)/t(4)	28(33%)
Test 2	ø(3)	ø(4)/p(2)	ø(4)/p(2)/t(4)	19(23%)
Total	7 (15%)	16(34%)	24(51%)	47(28%)

Table 3. Individual Perceptual Errors of Intervocalic Plosive Clusters

T e s t 1						T e s t 2						
kk	tk	pk	pt	kp	kt		kk	tk	pk	pt	kp	kt
	kk	kk	tt	pp	tt	H	tk			tt	pp	tk
				pp		R						
				pp	tt	W	x	x	x	x	x	x
					pt	U						
	kk		tt	pp	tt	I					pp	tt
	kk				tt	K					pp	tt
			tt	pp	tt	N				tt	pk	tt

Table 4. Total Errors of Intervocalic Plosive Clusters

	kk	tk	pk	pt	kp	kt	
Test 1		kk(3)	kk(1)	tt(3)	pp(5)	tt(5)/pt(1)	18
Test 2	tk(1)			tt(2)	pp(3) pk(1)	tt(3)/tk(1)	11
Total	1	3	1	5	9	10	29

Now the results of the perception test of intervocalic clusters can be tabulated in two different ways, i.e. Table 3 (Individual Perceptual Errors of Intervocalic Plosive Clusters) and Table 4 (Total Perceptual Errors of Intervocalic Plosives Clusters) as in the case of syllable-final plosives.

8. Interpretation of Results

The results of the perception test for both the syllable-final plosives and intervocalic plosive cluster may be interpreted as follows:

1) As can be readily in Table 1 and 2, the rate of perceptual errors is highest for k, and lowest for p. It is interesting to note that an articulatorily backward sound has a higher rate of error than an articulatorily forward sound. In other words, bilabial p which has an anterior position of articulation shows the lowest rate of error whereas velar plosive k, the most anterior sound of three, shows the highest rate of error, with alveolar t coming in between.

In Table 1 and 2, each of the plosives p, t, k seems to occur four times in the perception test. But taking

into account the seven informants taking part in the test, one can see that in fact each plosive sound is to be heard and judged 28 times in all (i.e., $4 \times 7 = 28$). Accordingly, k sound which scored 14 mistakes shows a very high error rate of 50%.

2) The nature of perceptual errors also reveals an interesting phenomenon. As can be seen in Table 2, a plosive with a posterior point of articulation is misheard as one with a frontier articulation. With the exception of \emptyset , which is left unmarked, t sound are systematically misheard as p, and k sound as t or p. Furthermore, there is not a single case of alveolar t being misheard as velar k, and the same is true of p sound which was never misheard as t or k. This type of perceptual errors may be termed "Progressive" since the direction of perceptual errors is mainly forward, and not backward. The progressive nature of perceptual errors made by Japanese speakers seems to be in an interesting correlation with their tendency to misjudge posterior plosives more often than anterior ones.

3) Another interesting point to make is the fact that there is a significant difference in the rate of perceptual errors between the first and second test, the latter showing a considerably lower error rate. For instance, t sound which was misheard ten times in the first test, was misheard only six times in the second test. Similarly, 14 errors of k sound in Test 1 was reduced to 10 in Test 2. And the total of 28 errors in Test 1 was to 19 errors in the Test 2, showing almost 32% improvement.

4) According to their relative error rate, the intervocalic plosive clusters can be arranged in the order of kt, kp, tk, pk, kk where the error rate is highest for

kt and lowest for kk. The most striking feature to note here is that the first of the two plosives forming a cluster is regularly identified with the second one. Thus, kt, kp, pt are perceived as tt, pp and tt respectively. This phenomenon may be interpreted as providing a strong evidence for the difficulty that Japanese speakers experience in perceiving unexploded plosive consonants.

5) The clusters kt and kp show a very high rate of perceptual errors (19), accounting for almost 66% of total number of errors (29). One thing that clusters kt and kp have in common is that both of them begin with k, an element that scored highest error rate in the syllable-final position. Consequently, there seems to be no denying the fact that velar plosive k is a principal error-maker wherever it occurs. However, cluster kk marks only a negligible error rate of 3% in the test although it comprises two /k/s. This phenomenon is clearly accounted for by the Japanese tendency to identify the first element of a plosive cluster with the second one.

6) As in the case of syllable-final plosives, the error rate of intervocalic plosive clusters dropped from 18 in Test 1 to 11 in Test 2, a net improvement of 39%. This seems to indicate that phonetic perception can improve with training, and perception test itself is in a sense a good ear-training exercise.

7) The perception test of plosives shows that there are individual differences in perceptual ability. As can be seen in Table 1 and 3, for instance, the informant U made only one mistake in the entire test whereas the informant I made as many as 27 mistakes. Such individual difference may be interpreted as being conditioned by various factors such as natural phonetic talent,

unconscious or deliberate ear training through foreign language acquisition, etc. The improved result of Test 2 over Test 1 may be taken as an undeniable evidence for the possibility of perceptual improvement by training.

9. Conclusion and Suggestion

The following conclusion and suggestion may be drawn from the present perception test for Japanese.

1) Japanese speaker have difficulty identifying the three syllable-final plosives and the errors rate comes in the order of k, t, p.

2) The direction of perceptual errors made by Japanese speakers may be termed "Progressive" in that posterior articulation is almost exclusively perceived as anterior articulation. That is velar k is misheard as alveolar t of labial p, and t as p.

3) Intervocalic plosive clusters are just as difficult Japanese speakers to identify correctly as syllable-final plosives. The initial k in the clusters kt and kp are most difficult for them to identify.

4) Japanese speakers show a strong tendency to identify the initial element of plosive clusters with the second element; i.e. tk=kk, pk=kk, pt=tt, kp=pp, kt=tt. This tendency is no doubt due to the fact that Japanese speakers are accustomed to listen only to such homorganic plosive clusters like kk, pp, tt and this in turn might be taken as a direct corollary of the so-called "Sokuon" (double consonant) in Japanese; e.g., "gakko" (school), "hotto" (hot coffee), "kippu" (ticket)

5) The results of the perceptual test reported in this paper is just a beginning. No doubt, further in-

vestigation is required before one can draw a complete picture of the perceptual tendency of Koreans and Japanese.

Furthermore, it will be extremely interesting to find out to what extent perceptual ability is influenced or conditioned by the phonetic or linguistic structure of listeners' mother tongue, and what is the most effective way of improving phonetic perception.

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