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# PERCEPTION OF MORA SOUNDS IN JAPANESE BY NON-NATIVE SPEAKERS OF JAPANESE

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## Introduction

For learners of Japanese, the problem of the mora sounds has often been noted. Japanese (in this paper the Tokyo dialect is meant by "Japanese") is said to have three mora phonemes: /N/, /Q/ and /H/.

/N/ is manifested as a nasal consonant or a nasalized vowel whose place of articulation is assimilated to the following sound.

/Q/ is manifested as the same voiceless consonant as the following consonant.

/H/ is manifested as the same vowel as the following vowel.

What kinds of acoustic cues are used by Japanese for these mora sounds was studied by Fujisaki et al. (1973). In this study, it was made clear that the Japanese discriminate between a single nasal and a geminate nasal using the duration of the nasal period as a cue, and between a single voiceless consonant and a geminate consonant using the duration of the lack of sound or the fricative sound period as a cue, and between a long vowel and a short vowel using the duration of the vowel as a cue. Moreover, the duration was discriminated in relation to the duration of the preceding mora. This result suggested that the mora sounds are processed using duration as an acoustic cue, though the acoustic characteristics of the sounds manifested are quite different from one another.

It has been pointed out that the phonetic ability of learners of a second language is affected by their own native language. It is said that language learners have difficulty in pronouncing and hearing sounds which they do not have in their native language, or whose distinction they do not have.

Therefore, difficulty in hearing mora sounds in Japanese is supposed to vary according to the learners' native language, and also according to the acoustic characteristics of the mora sounds themselves.

A listening test for mora sounds was carried out with the learners whose native language was one of the following four: Chinese, Thai, Indonesian and Korean. The listening test was performed on the following four points.

1. Identification of the word accent pattern.
2. Identification of a single voiceless consonant and corresponding geminates.
3. Identification of long and short vowels.
4. Distinction between single nasal consonants, geminate nasal consonants and nasalized vowels.

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## Method

### Stimuli

The stimulus word sets are shown in Table 1.

Set 1 and set 2 are a combination of the identification of long vowels and short vowels, with word accent pattern identification.

Set 3 is a combination of the identification of single voiceless fricatives and geminates, with word accent pattern identification.

Set 4 is a combination of the identification of single voiceless stops and geminates, with word accent pattern identification.

Sets 5-8 are distinctions among single nasal consonants, geminate nasal consonants and nasalized vowels. Set 5 and set 6 include the alveolar nasal, while set 7 and set 8 contain the velar nasal. The words in set 5 and set 7 have a flat accent pattern, while those in set 6 and set 8 have a falling accent pattern.

These words were embedded in the carrier sentence "Sore wa ____ to yomimasu (This is read ____)." These sentences were pronounced three times at a normal speed by four Japanese native speakers (2 males, 2 females) and were recorded.

Eight tapes were edited, one tape for each set, arranging the recorded sentences in a random order. Each sentence appeared three times. The interval between the stimuli was about three seconds, and a signal sound appeared every five stimuli. In each tape of sets 1-4, 144 stimuli were heard; in other words, three tokens of four sentences pronounced three times by four speakers. Likewise, in each tape of sets 5-8, 216 stimuli were heard.

### Subjects

The subjects were learners of Japanese staying in Japan. Information on the subjects is shown in Table 2. The approximate period spent studying Japanese prior to this study is shown in the table, but the degree of acquisition was difficult to estimate.

As the Thai and Indonesian subjects had been at the same Japanese school for 4 months, and since in the beginning they knew nothing about Japanese, they could all be considered to be at the latter half of the beginner's level.

Though the Korean subjects varied a little in the intensiveness and the length of their study of Japanese, they were considered to be at the intermediate level. The six Korean subjects are all from Seoul.

The Chinese subjects also varied in the intensiveness and the length of their study of Japanese. There was one who had studied for more than 3 years. One was studying for a master's degree, seven for a bachelor's degree, and they all used Japanese while attending courses and seminars. They had a high level of

ability in Japanese, and they could be considered to be at an advanced level. Two of the Chinese subjects were native speakers of Mandarin; six were bilingual in Mandarin and Taiwanese; and two were native speakers of Taiwanese who could also use Mandarin.

### Procedure

The listening test was carried out using the recorded stimuli. The stimuli were presented in a language laboratory via a speaker to the Thai and the Indonesian subjects, and in a soundproof chamber via a speaker to the Chinese and the Korean subjects.

There were 4 alternatives (sets 1-4) or 6 alternatives (sets 5-8) on the answer sheets, and the subjects were asked to circle only one choice immediately after they heard each stimulus.

Rest was given between the tapes if necessary. Almost all of the subjects took one rest through the eight tapes. It took about two hours and ten minutes to listen to the eight tapes without rest.

## RESULTS AND DISCUSSION

### Accent patterns, vowel length, consonant length

The hit rate and the error rate for the identification of word accent pattern, long vowels vs. short vowels, and single voiceless consonants vs. geminates (sets 1-4) are shown in Table 3.

The identification of the word accent patterns was better in the Chinese and Thai subjects than in the Korean and Indonesian subjects. Since Chinese and Thai are tone languages, it was concluded that the subjects' native language had had a clear influence upon the identification of the accent patterns in Japanese.

The error rate for confusions of long vowels with short vowels was too small to discuss, though the three subject languages (excluding Thai) did not have long vowels. It was concluded that the identification of long vowels and short vowels was not difficult in the first syllable of the stimulus word.

The error rate for confusions of single consonants with geminates was larger than that for vowels. Thai and Indonesian are considered to have phonemically similar consonantal geminates, but the error rates of the four groups of subjects were close to each other. It can be suggested that the acoustic cues for the identification of the voiceless geminate consonant in Thai and in Indonesian are different from those in Japanese.

Nasals and the nasalized vowel

Concerning the nasals and the nasalized vowel (sets 5-8), the hit rate and the error rate on the five distracters were counted for every stimulus. These error rates were classified into two types; confusions and omissions & additions. Confusions were errors among single nasals, geminate nasals and the nasalized vowel, while omissions & additions were errors whose nasal consonant or the nasalized vowel was omitted, or the reverse.

The two types of summed error rate are shown in Table 4.

Compared to the summed error rate of the Indonesian subjects, the Thai subjects had the same rate of confusion errors, while they had a nearly double rate for omission & addition error. Therefore, the Thai subjects had a higher ratio of omissions & additions to confusions than the Indonesian subjects.

The Chinese subjects had a smaller rate for confusion errors than the Indonesian subjects, but nearly 2.4 times their number of omissions & additions. Therefore, the Chinese subjects had a higher ratio of omissions & additions to confusions than the Indonesian and Thai subjects.

On the other hand, the Korean subjects had the larger rate both for confusions and omissions & additions, and the ratio of omissions & additions to confusions was similar to that of the Indonesian subjects.

In order to examine these differences in error rates, place of articulation was considered. The two error rates were calculated according to the place of articulation (alveolar and velar) and are shown in Table 5.

For confusion errors in every group of subjects, velar nasals caused more than 4 times the number of errors as the alveolar nasals.

As for the omission & addition errors in the Chinese and Thai subjects, velar nasals caused 2 times the number of errors as the alveolar nasals.

On the other hand, the omission & addition errors of the Korean and Indonesian subjects were caused equally by the velar and the alveolar nasals.

The differences in the error rates of omission & addition between the Indonesian subjects and the Thai subjects were due to the differences in the error rates caused by the velar nasals, and also those between the Indonesian subjects and Chinese subjects.

It can be supposed that, as velars are located in the inner part of the oral cavity, nasalized vowels sound like velar nasals to subjects whose languages do not have nasalized vowels. Thus, they are liable to confuse nasalized vowels, the single velar nasals and their geminates.

On the other hand, omission & addition errors were considered confusions between VV and VCV (or VṼV). It can be supposed that, as Indonesian and Korean have VV sequences, velar nasals, as well as alveolar nasals, functioned to distinguish VV from VCV. On the other hand, as Chinese and Thai do not have VV se-

quences, and as the velar nasal sounded a little like a vowel sequence to Chinese and Thai subjects, it pushed up the rate of omission & addition errors for the Chinese and Thai subjects.

In order to examine further the differences in rate shown in Table 4, the two error rates for single nasals were calculated separately according to the length of the preceding vowel.

The rates of confusion by the Thai subjects and by the Indonesian subjects were very close, but the difference caused by the short vowel was different. The Thai subjects had a larger error ratio caused by a preceding short vowel.

The Korean subjects had a larger rate of confusion under both conditions of preceding short and long vowels. The higher rate of omission & addition errors by the Korean subjects than by the Thai subjects were accounted for by the higher rate of errors caused by a preceding long vowel.

In Thai, long vowels are unmarked and short vowels are marked. Therefore, generally speaking, Thais feel difficulty in acquiring Japanese short vowels. On the other hand, Chinese has short vowels and not long vowels. These reasons may explain why Thai subjects showed a higher error rate caused by a preceding short vowel, while the Chinese subjects showed a lower error rate in the same context.

But these reasons do not seem capable of accounting for the nearly identical ratio of omission & addition error rates for the subjects caused by the long and short vowels.

Omission & addition errors were more frequently caused in the Indonesian and Korean subjects under the condition of a preceding long vowel than short vowel. But in the Chinese and Thai subjects, omission & addition errors were independent of the preceding vowel condition.

These two types of errors seem to be related to different causes. Generally, the Korean subjects showed a higher error rate than the other three groups of subjects, but the ratio and the tendency of the errors were close to those of the Indonesian subjects. Indonesian and Korean have basic words made up of more than one syllable, while Chinese and Thai have basic words of one syllable. It can be supposed that this difference in the syllable construction of Chinese and Thai vs. Indonesian and Korean underlies the general tendency for all of the error types.

Further studies will be conducted to investigate the correspondence between the phonetic pattern of a native language and error types in the perception of nasal sounds.

Reference

Fujisaki, H., Nakamura, K. and Imoto, T. : Auditory Perception of Duration of Speech and Non-Speech Stimuli. IEICE Technical Report, S73-12, 1973.

TABLE 1
WORD LIST

| set 1 | set 2 | set 3 | set 4 |
|---|---|---|---|
| kɔ̃:dai | ɕɔ̃:ko: | ĩɕɕo: | ĩkko: |
| ko:dai | ɕo:ko: | iɕɕo: | ikko: |
| kɔ̃dai | ɕɔ̃ko: | ĩɕo: | ĩko: |
| kodai | ɕoko: | iɕo: | iko: |

| set 5 | set 6 | set 7 | set 8 |
|---|---|---|---|
| senno: | hɔ̃nno | hoŋŋan | kɛ̃ŋŋo |
| seũo: | hɔ̃ũo | hoãan | kɛ̃ũo |
| se:no: | hɔ̃:no | ho:ŋan | kɛ̃:ŋo |
| se:o: | hɔ̃:o | ho:an | kɛ̃:o |
| seno: | hɔ̃no | hoŋan | kɛ̃ŋo |
| seo: | hɔ̃o | hoan | kɛ̃o |

TABLE 2
SUBJECTS

| NATIVE LANGUAGE | THAI | INDONESIAN | CHINESE | KOREAN |
|---|---|---|---|---|
| NUMBER OF SUBJECTS (MALE/FEMALE) | 10(8/2) | 9(8/1) | 8(2/6) | 6(5/1) |
| TIME STUDYING JAPANESE | 4 MONTHS | 4 MONTHS | 2 YEARS | 1 YEAR |
| AGE | 18-21 | 18-21 | 21-32 | 27-34 |

TABLE 3
CORRECT RATE AND ERROR RATE OF
ACCENT, LONG-SHORT VOWEL OR CONSONANT

CHINESE

| | CORRECT RATE | ERROR RATE | | |
|---|---|---|---|---|
| | | ACCENT | BOTH | LONG-SHORT |
| set 1(vowel+accent) | 90 | 7 | 1 | 2 |
| set 2(vowel+accent) | 86 | 8 | 2 | 4 |
| set 3(consonant+accent) | 74 | 3 | 1 | 22 |
| set 4(consonant+accent) | 73 | 3 | 1 | 23 |

THAI

| | CORRECT RATE | ERROR RATE | | |
|---|---|---|---|---|
| | | ACCENT | BOTH | LONG-SHORT |
| set 1(vowel+accent) | 76 | 16 | 4 | 4 |
| set 2(vowel+accent) | 76 | 16 | 3 | 5 |
| set 3(consonant+accent) | 58 | 6 | 5 | 31 |
| set 4(consonant+accent) | 65 | 5 | 4 | 26 |

INDONESIAN

| | CORRECT RATE | ERROR RATE | | |
|---|---|---|---|---|
| | | ACCENT | BOTH | LONG-SHORT |
| set 1(vowel+accent) | 61 | 29 | 5 | 5 |
| set 2(vowel+accent) | 60 | 29 | 6 | 5 |
| set 3(consonant+accent) | 50 | 24 | 11 | 15 |
| set 4(consonant+accent) | 60 | 21 | 9 | 10 |

KOREAN

| | CORRECT RATE | ERROR RATE | | |
|---|---|---|---|---|
| | | ACCENT | BOTH | LONG-SHORT |
| set 1(vowel+accent) | 48 | 39 | 5 | 8 |
| set 2(vowel+accent) | 49 | 31 | 9 | 11 |
| set 3(consonant+accent) | 45 | 26 | 11 | 18 |
| set 4(consonant+accent) | 44 | 23 | 14 | 19 |

TABLE 4
SUMMED ERROR RATE OF CONFUSION, OMISSION & ADDITION ERRORS

| | CHINESE | THAI | INDONESIAN | KOREAN |
|---|---|---|---|---|
| CONFUSION | 225 | 278 | 276 | 341 |
| OMISSION & ADDITION | 155 | 124 | 65 | 137 |
| (OMISSION/ADDITION) | (105/50) | (67/57) | (37/28) | (87/50) |

TABLE 5
SUMMED ERROR RATE OF CONFUSION, OMISSION & ADDITION ERRORS OF ALVEOLAR AND VELAR CONSONANTS

| | CHINESE | THAI | INDONESIAN | KOREAN |
|---|---|---|---|---|
| CONFUSION | | | | |
| ALVEOLAR NASAL (set5+set6) | 39 | 55 | 50 | 60 |
| VELAR NASAL (set7+set8) | 186 | 223 | 226 | 281 |
| OMISSION & ADDITION | | | | |
| ALVEOLAR NASAL (set5+set6) | 51 | 43 | 39 | 69 |
| VELAR NASAL (set7+set8) | 104 | 81 | 26 | 68 |

TABLE 6
SUMMED ERROR RATE OF CONFUSION, OMISSION & ADDITION ERRORS PRECEDING LONG AND SHORT VOWELS

| | CHINESE | THAI | INDONESIAN | KOREAN |
|---|---|---|---|---|
| CONFUSION | | | | |
| LONG VOWEL+NASAL | 71 | 60 | 78 | 121 |
| SHORT VOWEL+NASAL | 55 | 120 | 101 | 149 |
| OMISSION & ADDITION | | | | |
| LONG VOWEL+NASAL | 62 | 40 | 25 | 60 |
| SHORT VOWEL+NASAL | 57 | 39 | 13 | 35 |