SUBMORAIC AWARENESS BY JAPANESE SCHOOL CHILDREN: EVIDENCE FROM A NOVEL GAME

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ABSTRACT
The present study has attempted to investigate the relationship between morae and phonemes with respect to phonological awareness by Japanese school children. The main question addressed in this study is whether Japanese school children can be aware of phonemes as a submoraic unit in Japanese if they are given the information on the internal structure of morae. Two experiments were conducted with two groups of Japanese elementary school children with and without alphabetic knowledge, employing a novel apparatus which can make them understand the relationship intuitively. The results show that Japanese school children regardless of alphabetic knowledge can recognize the relationship between them. This suggests that they can access to the phonemic level if they are provided with the appropriate information.

1. INTRODUCTION
Recent studies in the field of phonetics and phonology as well as psycholinguistics have given ample evidence to support for the fact that morae play a vital role in Japanese. For example, it is reported that morae are the basic unit in the study of speech error and syllable structure in Japanese [1][2]. In the field of speech segmentation study in Japanese they are considered to be a very important cue [3][4][5][6]. It is also reported that morae may be recognized by Japanese preschool children at the earlier stage before they acquire Japanese kana orthography [7][8].

Although morae play a vital role in Japanese as mentioned above, it should be noted that they are a subsyllabic unit of syllables. In other words, recognition of morae may infer that Japanese speakers are aware of syllables, which are defined as a higher unit. Some recent experimental studies supply evidence for it. For example, Japanese-English bilingual speakers can be aware of both morae and syllables depending upon input materials [9][10]. Japanese preschool children who have not yet acquired kana orthography may be aware of both syllables and morae and the order of the recognition may develop from syllables to morae [8], which could be a good evidence to support for Treiman’s linguistic status hypothesis [9]. All the experimental evidence reported here seems to suggest that Japanese speakers may be sensitive to both syllables and the subsyllabic constituents within syllable structure.

A further interesting question arises from the above findings. If Japanese speakers are sensitive to the internal constituents of syllable structure, they may be able to access to phonemes, which are a submoraic unit. The latest speech segmentation studies report that Japanese speakers are able to access to the phoneme level [11][12]. In the speech segmentation studies, it is assumed that phonemes are the fundamental unit for word activation in the mental lexicon [13]. In other words, if Japanese speakers can access to the phonemic level, there may be a chance for Japanese speakers to activate word candidates on the basis of “the common unit.” In this sense, it is worth investigating how Japanese recognize phonemes as a submoraic unit, which is our main concern in the present study.

The study of phonemic awareness has been mainly investigated with respect to the literacy of Roman alphabets [14][15][16], although some researchers have suggested that it is a part of the language acquisition capacity [17][18][19]. Although a large number of the studies regarding phonemic awareness have been reported in the literature, it seems that almost all these studies have been conducted without giving an explicit definition of phonemes to subjects. For example, in the studies of Morais and his colleagues the instruction of their experiments was simply told to count the number of phonemes [15]. The major problem in this task was that they were not told what they were expected to count. Thus, speakers with non-alphabetic orthography may have been handicapped because they did not know what their task was explicitly. Thus, in the present study we decided to conduct two experiments with a novel task which gives the concept of phonemes lying under morae with Japanese school children with and without having alphabetic knowledge.

2. EXPERIMENT 1
Experiment 1 aimed at examining whether phonemic awareness can exist with two groups of Japanese school children by having them delete consonants word initially.

2.1. Method
2.1.1. Materials
Two types of Japanese words were used in this experiment. Type I words were 15 Japanese meaningful words which are made up of two morae (kuma, shika, soto, tsune, tori, nishi, numa, hito, huta, hebi, mago, mushi, yume). All these words can be meaningful even if the word initial consonant is deleted. For example, kuma ‘a bear’ can be such a word because uma ‘a horse’ is created when the word initial consonant is deleted. Type II words were 5 Japanese meaningless words which are...
also made up of two morae (hote, nagu, chige, suwa, geshi). All these words were meaningless if the word initial consonant was deleted. The main reason why Type II words were included was to see if they simply guessed known words.

2.1.2. Subjects

Subjects were 30 Japanese school children who were recruited from the third and fourth graders at Kazahaya-Nanbu Elementary School, Chiba prefecture in Japan. These subjects were divided into two groups depending upon their grades: 15 third graders (the average age was 9 years and 7 months) and 15 fourth graders (the average age was 10 years and 6 months). All these subjects had no experience of living in English speaking countries nor of attending an English language school. The fourth graders had learned Romanji at school, while the third graders had not learned it.

For the purpose of knowing children’s acquisition of Roman letters, the subjects of both groups took part in both reading and writing test, in which they were asked to read and write 5 words in Roman letters. The third graders could not recognize nor write 94.7% of five stimuli randomly chosen, while the fourth graders could recognize nor write 77%.

2.1.3. Procedure

In this experiment, plastic toys such as a watermelon and an apple, which can be cut into two pieces with a plastic knife was employed as apparatus. This toy is called 'mamagoto-tonton' which is available commercially at a toy store in Japan as shown in Figure 1. The advantage of this toy to use in the current experiment was that it was helpful to introduce the concept that a solid object such as an apple or a watermelon could be split into two pieces. In other word, a mora can be designated as a unit consisting of two constituents intuitively.

With this toy, the experiment was conducted in the following way.

1. Training Phase

Step 1: A plastic apple was placed in front of a subject and a single mora word ke ‘hair’ was provided orally. The subject was then told that there were two segments in the word, cutting the apple into two pieces. When the apple was divided into two pieces and the left piece was taken away, he or she was told that the remaining became e ‘a picture’ which is shown in Figure 2.

2. Experimental Phase

Step 3: Two plastic fruits were placed in front of a subject and a two mora word was provided orally. Then, the experimenter asked the subject to cut the first plastic fruit into two pieces and the left piece was taken away which is shown in Figure 3. And he or she was asked to say the new word.

2.2. Results and Discussion

The number of choices for correct and miss responses for Type I and Type II words were shown in Table 1 and 2, respectively.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Correct response</th>
<th>Miss response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Third graders</td>
<td>219 (97.3%)</td>
<td>6 (2.7%)</td>
</tr>
<tr>
<td>Fourth graders</td>
<td>224 (99.5%)</td>
<td>1 (0.5%)</td>
</tr>
</tbody>
</table>

Table 1 Responses for Type I words by two subject groups

<table>
<thead>
<tr>
<th>Subject</th>
<th>Correct response</th>
<th>Miss response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Third graders</td>
<td>74 (98%)</td>
<td>1 (1%)</td>
</tr>
<tr>
<td>Fourth graders</td>
<td>71 (95%)</td>
<td>4 (5%)</td>
</tr>
</tbody>
</table>

Table 2 Responses for Type II words by two subject groups

As can be seen from these two tables, both subject groups could successfully delete the initial consonant and say the expected words correctly (The third graders: Type I words ($z = -3.54$, $p<0.001$) and Type II words ($z = -2.12$, $p<0.05$); the
fourth graders: Type I words \( (z = -3.87, p<0.001) \) and Type II words \( (z = -2.04, p<0.05) \). There was no significant difference between the third graders and the fourth graders for both word types. These results suggest that both subject groups can manipulate a phoneme deletion word-initially irrespective of their alphabetic knowledge. In other words, once the concept of the phonemes are appropriately provided, Japanese school children can recognize them.

3. EXPERIMENT 2

Experiment 2 aimed at examining the same goal as in Experiment 1 by having them delete consonants from the second mora word-medially. If they can manipulate the word initial consonant as shown in Experiment 1, they should be able to do it word-medially.

3.1. Method

3.1.1. Materials

Two types of Japanese words were used in this experiment. Type I words were 15 Japanese meaningful words which are made up of two morae \( \text{toki, hashi, meshi, sato, hane, yomu, shimo, hitokari, shiro, kago, kaji, kujii, fude, nabe, tabi} \). All these words can be meaningful even if the word-medial consonant is deleted. For example, \text{toki} ‘time’ can be such a word because \text{toi} ‘a drainpipe’ is created when the word-medial consonant is deleted. Type II words were 5 Japanese meaningless words which are also made up of two morae \( \text{yayu, sado, muchi, fuka, muga} \). All these words were meaningless if the word initial consonant was deleted. The main reason why Type II words were included was to see if they simply guessed known words.

3.1.2. Subjects

The subjects were the same subjects who participated in Experiment 1.

3.1.3. Procedure

The procedure was basically the same as the one in Experiment 1 except that a consonant in the second mora was deleted as shown in Figure 4. For example, after introducing the training phase, they were asked to repeat a word, \text{toki}, first. And then they were asked to cut the second plastic fruit with a plastic knife and say a new word. As can be seen from Figure 4, the second consonant ‘k’ was taken away. Then, the remaining word became \text{toi}.

![Figure 4. Experimental Phase](image)

3.2. Results and Discussion

The number of choices for correct and miss responses for Type I and Type II words were shown in Table 3 and 4, respectively.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Correct response</th>
<th>Miss response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Third graders</td>
<td>221 (98%)</td>
<td>4 (2%)</td>
</tr>
<tr>
<td>Fourth graders</td>
<td>224 (99%)</td>
<td>1 (1%)</td>
</tr>
</tbody>
</table>

Table 3 Responses for Type I words by two subject groups

<table>
<thead>
<tr>
<th>Subject</th>
<th>Correct response</th>
<th>Miss response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Third graders</td>
<td>73 (97%)</td>
<td>2 (3%)</td>
</tr>
<tr>
<td>Fourth graders</td>
<td>73 (97%)</td>
<td>2 (3%)</td>
</tr>
</tbody>
</table>

Table 4 Responses for Type II words by two subject groups

As can be seen from these tables, both subject groups could delete the word-medial consonant and say the expected words correctly \( (\text{The third graders: Type I words } (z = -3.63, p<0.001) \text{ and Type II words } (z = -2.07, p<0.05); \text{ the fourth graders: Type I words } (z = -3.77, p<0.001) \text{ and Type II words } (z = -2.57, p<0.05). \text{ There was no significant difference between the third graders and the fourth graders for both word types. These results suggest that both subject groups can manipulate a phoneme deletion word-medially irrespective of their alphabetic knowledge. \) \)

4. Discussion & Conclusions

The present study has attempted to investigate the relationship between morae and phonemes as a submoraic unit with respect to phonological awareness by Japanese school children. The main question addressed in this study was whether Japanese school children can be aware of phonemes as a submoraic unit in Japanese if they are given the relevant information.

The results in the present study have clearly shown that both groups of Japanese school children could be sensitive enough to phonemic consonants word-initially and word-medially. In other words, Japanese school children can be aware of phonemes.

It was introduced in the present study that there were submoraic units lay under a single mora intuitively, using a novel task in the present study. As mentioned in the introduction, the study of phonemic awareness has been conducted without giving explicit knowledge on the concept of phonemes in relation to morae to the participants in the previous studies. As the result, the previous studies were inclined to conclude that Japanese children were not sensitive to phonemes [15], although some study suggests that they are able to aware of it [17]. However, the present study has shown that Japanese school children were full aware of phonemes if they were given the relevant information on morae and phonemes. How can we account for the discrepancies between the results in the previous studies and present study?

One possible interpretation is that Japanese school children at the third grade may already have knowledge on the internal structure of morae, although their primary focus is at the moraic level. The important point of this interpretation is that
it is irrelevant to the knowledge of alphabetic orthography because the third graders who participated in the present study had little knowledge on it.

This interpretation may be justifiable if we examine the cases of Japanese word play called goroawase which was popular among ordinary Japanese during the 19th century [11]. Goroawase is a form of punning in Japanese. In its traditional form, the game is to make a comment which is at the same time a subtle distortion of a name, a quotation from poetry or literature, or a proverb. According to the analysis in this study, in spite of the fact that the ordinary people during the Edo period during the 19th century had no knowledge on alphabetic knowledge, they could play the game with consonantal distortion as well as moraic distortion. If the manipulation of the internal structure of morae seems to occur irrelevant to alphabetic orthography, as claimed in other studies [18][19].

In fact, our most recent study has revealed that the modern Japanese enjoy dajare which is similar to goroawase in the sense that phonemic as well as moraic distortion is employed [12]. The important difference between goroawase and dajare is that although the former may be off-line by nature, the latter may be one-line in the sense that this game is played spontaneously. In other words, if we assume that Japanese can only focus on the moraic level, Japanese may not be able to enjoy this kind of a word game.

As we have shown that the Japanese school children are fully aware of the phonemic level, a further research may be needed to test if the third graders can play dajare. We anticipate that there is no reason that they cannot play it.

5. Acknowledgement

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6. References