PHONOLOGICAL AWARENESS: THE ROLE OF READING EXPERIENCE*

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Abstract. A cross-cultural study of Japanese and American children has examined the development of awareness about syllables and phonemes. Using counting tests and deletion tests, Experiments I and III reveal that in contrast to first graders in America, most of whom tend to be aware of both syllables and phonemes, almost all first graders in Japan are aware of mora (phonological units roughly equivalent to syllables), but relatively few are aware of phonemes. This difference in phonological awareness may be attributed to the fact that Japanese first graders learn to read a syllabary, whereas American first graders learn to read an alphabet. For most children at this age, awareness of phonemes may require experience with alphabetic transcription, whereas awareness of syllables may be facilitated by experience with a syllabary, but be less dependent upon it. To clarify further the role of knowledge of an alphabet on children's awareness of phonemes, Experiments II and IV administered the same counting and deletion tests to Japanese children in the later elementary grades. Here the data reveal that many Japanese children become aware of phonemes by age ten whether or not they have received instruction in alphabetic transcription. Discussion of these results focuses on some of the other factors that may promote phonological awareness.

Introduction

The primary language activities of listening and speaking do not require an explicit awareness of the internal phonological structure of words any more than they require an explicit awareness of the rules of syntax. Yet a "metalinguistic" awareness that words comprise syllables and phonemes is precisely what is needed when language users turn from the primary language activities of speaking and listening to the secondary language activities of reading, versification, and word games (Liberman, 1971; Mattingly, 1972,

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1984). While all members of a given community become speakers and hearers, not all become readers, nor do they all play word games or appreciate verse. This difference raises the possibility that the development of phonological awareness might require some special cultivating experience above and beyond that which supports primary language acquisition.

Several different research groups have reported that adults who cannot read an alphabetic orthography are unable to manipulate phonemes (Byrne & Ledez, 1986; Liberman, Rubin, Duqčès, & Carlisle, 1985; Morais, Cary, Alegria, & Bertelson, 1979; Read, Zhang, Nie, & Ding, 1984), raising the possibility that knowledge of the alphabet is essential to awareness of phonemes. In further pursuit of the factors that give rise to phonological awareness, the present study has explored the awareness of syllables and phonemes among Japanese children and American children. This particular cross-linguistic comparison is prompted by certain differences between the English and Japanese orthographies, and by certain differences in the word games and versification devices that are available to children in the two language communities.

Children in America learn to read the English orthography, an alphabet that represents spoken language at the level of the phoneme. Many of them also play phoneme-based word games such as "pig-Latin" and "Geography," and learn to employ versification devices such as alliteration that involve manipulations of phonemes, as well as word games and versification devices that exploit meter and thus operate on syllable-sized units. In contrast, virtually all of the secondary language activities that are available to Japanese children manipulate mora—phonological units that are roughly equivalent to syllables—if they manipulate phonological structure at all. Japanese children learn to read an orthography that comprises two types of transcription: Kanji, a morphology-based system, and Kana, a phonology-based system. Kanji is derived from the Chinese logography and represents the roots of words without regard to grammatical inflections, whereas Kana is of native origin and comprises two syllabaries, Hiragana and Katakana, which can represent the root and inflection of any word in terms of their constituent mora. Typically, the two orthographies function together, with Kanji representing most word roots and Kana representing all word inflections and the roots of those words that lack Kanji characters. As for other secondary language activities, Japanese word games such as "Shiritori" (a mora-based equivalent of "Geography") and versification devices such as Haiku manipulate mora.

In short, Japanese secondary language activities do not manipulate language at the level of the phoneme, whereas several English secondary language activities are phoneme-based, most notably the alphabetic orthography. Both Japanese and English afford versification devices and word games that manipulate syllable-sized units, but the Japanese orthography is unique in its inclusion of a syllabary. Given these similarities and differences between the orthographies and other secondary language activities in English and Japanese, it may be reasoned that, if experience with secondary language activities plays a specific role in the development of awareness about syllables and phonemes, Japanese children should be aware of mora (syllables), whereas American children should be aware of both phonemes and syllables. Should the experience of learning to read a given type of orthography play a particularly critical factor, Japanese children should be more aware of syllables than their American counterparts, who should be more aware of phonemes. It seems unlikely that the possession of primary language
skills is sufficient to make Japanese and American children equivalent in awareness of phonemes, given findings that alphabet-illiterate adults are not aware of phonemes. However, it remains possible that children in the two countries will be equivalent in phonological awareness should reading experience or some other form of secondary language experience that draws the child's attention to the phonological structure of language promote the awareness of both syllables and phonemes.

The possibility that reading experience plays a particularly important role in the development of phonological awareness arises from the many studies that reveal an association between phonological awareness and success in learning to read an alphabetic orthography. These reveal that performance on tasks that require manipulations of phonological structure not only distinguishes good and poor readers in the early elementary grades (see, for example, Alegria, Pignot, & Morais, 1982; Fox & Routh, 1976; Katz, 1982; Liberman, 1973; Rosner & Simon, 1973) but also correlates with children's scores on standard reading tests (see, for example, Caffee, Lindamood, & Lindamood, 1973; Fox & Routh, 1976; Perfetti, 1985; Stanovich, Cunningham, & Freeman, 1984b; Treiman & Baron, 1983).

In many studies of reading ability and phonological awareness, the question of cause and effect has been broached, but never completely resolved. One of the earliest studies revealed that American children's awareness of phonological structure markedly improves at just that age when they are beginning to read (Liberman, Shankweiler, Fischer, & Carter, 1974): Among a sample of four, five, and six-year-olds, none of the youngest children could identify the number of phonemes in a spoken word, while half could identify the number of syllables; of the five-year-olds, 17 percent could count phonemes while, again, half could count syllables. Most dramatically, 70 percent of the six-year-olds could count phonemes and 90 percent could count syllables. Did the older children become aware of syllables and phonemes because they were learning to read, was the opposite true, or both?

Certain evidence suggests that phonological awareness can precede reading ability or develop independently. First of all, various measures of phoneme awareness and syllable awareness are capable of presaging the success with which preliterate kindergarten children will learn to read the alphabet in the first grade (see, for example, Bradley & Bryant, 1983; Helfgott, 1976; Jusczyk, 1977; Liberman et al., 1974; Lundberg, Olofsson, & Wall, 1980; Mann, 1984; Mann & Liberman, 1984; Stanovich, Cunningham, & Cramer, 1984a). Second, there is evidence that explicit training in the ability to manipulate phonemes can facilitate preliterate children's ability to learn to read (Bradley & Bryant, 1985). Third, the awareness of syllables, in particular, does not appear to depend upon reading experience, as the majority of preliterate children can manipulate syllables by age six without having been instructed in the use of a syllabary or an alphabet (Amano, 1970; Liberman et al., 1974; Mann & Liberman, 1984), and the ability to manipulate syllables is not strongly influenced by the kind of reading instruction, "whole-word" or "phonics," that children receive in the first grade (Alegria et al., 1982).

Other evidence, however, has revealed that at least one component of phonological awareness—awareness of phonemes—may depend on knowledge of an alphabet. As noted previously, several different investigators have reported that the ability to manipulate phonemes is markedly deficient in adults who cannot read alphabetic transcription. Awareness of phonemes is deficient
among semi-literate American adults (Liberman et al., 1985), reading-disabled Australian adults (Byrne & Ledez, 1986), illiterate Portuguese adults (Morais et al., 1979), and Chinese adults who can read only the Chinese logographic orthography (Read et al., 1984). In addition, the type of reading instruction that children receive can influence the extent of their awareness: first-graders who have been taught to read the alphabet by a "phonics" approach tend to be more aware of phonemes than those who have learned by a "whole-word" method (Alegria et al., 1982).

Present evidence, then, suggests that the relationship between phonological awareness and reading ability is a two-way street (Perfetti, 1985), which may depend on the level of awareness being addressed. Awareness of syllables is not very dependent on reading experience and could be a natural cognitive achievement of sorts, whereas awareness of phonemes may depend upon the experience of learning to read the alphabet, in general, and on methods of instruction that draw attention to phonemic structure, in particular. As a test of this view, the present study examined the phoneme and syllable awareness of children in a Japanese elementary school, predicting that these children would be aware of syllables, but would not be aware of phonemes until that point in their education when they receive instruction in the use of alphabetic transcription.

The design of the study involves four experiments that focus on the awareness of syllables (mora) and phonemes among children at different ages. Two different experimental paradigms are employed as a control against any confounding effects of task-specific variables. One paradigm is the counting test developed by Liberman and her colleagues, a test used in several studies of phonological awareness among American children (see, for example, Liberman et al., 1974; Mann & Liberman, 1984). The other is a deletion task, much like that employed by Morais et al. (1979) and Read et al. (1984) in their studies of alphabet-illiterate adults.

Experiment I used the counting test paradigm to study Japanese first-graders who had recently mastered the Kana syllabaries. To clarify the impact of knowledge of a syllabary vs. an alphabet, the results are compared with those reported in Liberman et al.'s (1974) study of American first graders. The relation between reading and phonological awareness is also probed by an analysis of the relation between phoneme and syllable counting performance and the ability to read Hiragana, in which case a nonlinguistic counting test guards against the possibility that any correlations might reflect attention capacity, general intelligence, etc. To further clarify the role of knowledge of the alphabet, Experiment II extended use of the counting test paradigm to Japanese children in the third to sixth grades. In Japan, children routinely receive some instruction in alphabetic transcription (Romaji) at the end of the fourth grade. There also exist certain "re-entry" programs for fourth through sixth graders who have spent the first few years of their education abroad and who have learned to read an alphabetic orthography. Comparisons among the re-entering pupils and normal pupils at various grade levels clarifies the relative contribution of alphabetic knowledge vs. knowledge of Kana and Kanji.

Experiment III used the deletion test paradigm to replicate and extend the findings of Experiment I. Aside from the change in procedure, its major innovation was to employ nonsense words as stimuli, constructing them in a fashion to permit parallel testing of first graders in Japan and in America.
Analysis of the results concerns performance on each deletion test in relation to reading experience and reading ability. Finally, Experiment IV used the same paradigm in a partial replication of Experiment II, comparing Japanese fourth graders who had not received instruction in Romaji with sixth graders who had been taught about Romaji one and a half years prior to the test session.

Experiment I

Methods

Subjects

The subjects were 40 children attending the first grade of the primary school attached to Ochanomizu University, twenty girls and twenty boys chosen at random from the available population and serving with the permission of their parents and teachers. Mean age was 84.4 months at the time of testing, which was the beginning of the second trimester of the school year. As a measure of Hiragana reading ability, each child rapidly read aloud a list of thirty high-frequency nouns, adjectives, and verbs (Sasana, 1978), and the total reading time and the number of errors were recorded. Each child was also rated by his or her teacher as above-average, average, or below-average in Kana reading ability.

Materials

The experiment employed three sets of materials designed to measure the ability to count three types of items: mora, phonemes, and 30° angles (a nonlinguistic unit). All three sets were modeled after the materials of Liberman et al. (1974): Each contained four series of training items that offered the child an opportunity to deduce the nature of the unit being counted, followed by a sequence of test items. In the mora counting test and phoneme counting test, all training and test items were common Japanese words that had been judged by four informants (a linguist, a speech scientist, a teacher of Japanese, and a librarian) to be readily familiar to young children. In the angle counting test, the items were simple line drawings of abstract designs and common objects. A more complete description of each test follows.

Mora counting test. Mora are rhythmic units of the Japanese language that more-or-less correspond to syllables. Each mora is either an isolated vowel, a vowel preceded by a consonant, an isolated [n], or the first consonant in a geminate cluster. A basic difference between mora and English syllables is that mora cannot contain consonant clusters, in general, or consonants in final position. It is further the case that a single syllable of English may correspond to two mora of Japanese. This owes to the fact that, in a Japanese word such as hon, [n] can be a mora, whereas [n] cannot be a syllable of English, and to the fact that differences in vowel duration (one or two mora) and consonant closure duration (normal or an extra mora) distinguish minimal pairs of Japanese words but are not contrastive in English.

In the mora-counting test, each training series contained three words: two-, three- and four-mora in length. Within the first three series, the words formed a progressive sequence, as in hito (man), hitotsu (one),
hitotsubu (a grain or drop), but the words of the fourth series bore no such relation to each other [i.e., ima (now), kitte (stamp), chisai (small)]. To introduce some of the complexities of Japanese phonology, the third series included a voiced vowel, and the fourth included a long vowel and a geminate consonant. To avoid biasing the child's decision as to whether the task was to count the mora in a word (a phonological strategy) or the number of Kana characters needed to spell the word (a spelling strategy), the training items included only those mora that are spelled with a single character. Thus it was left ambiguous whether the task was to count orthographic units, or phonological ones.

The test sequence consisted of 14 two-mora words, 14 three-mora words, and 14 four-mora words presented in a fixed random order. They represented common combinations of mora including the nasal mora, geminate vowels, geminate consonants, and devoiced vowels. There were four VV words, two CVV words, six CVCV words and two CVC words in the two-mora pool; two VCVV words, two VVCCV words, two CVVV words, three CVCV words, two CVCCV words, and one CVVCV word in the three-mora pool, and four VCCVV words, VCCCVV words, one VCVVCCV word, four CVCCCVV words, two CVVVCCV words, and one CVCCCVV word in the four-mora pool. As a probe for whether children were counting mora or orthographic units, three of the test items included one of the Japanese mora spelled with two characters.

Phoneme counting test. The design was analagous to that for the mora-counting test, but items manipulated the number of phonemes instead of the number of mora. The four training series contained a variety of the possible two-, three-, and four-phoneme sequences of Japanese, including nasal mora, devoiced vowels, long vowels and geminate consonants. Each of the first three contained a progressive sequence of items [i.e., ho (sail), hon (book), hune (bone)], whereas the fourth did not (i.e., ta (field), kau (buy), shita (under)]. The test sequence contained 14 two-phoneme words, 14 three-phoneme words, and 14 four-phoneme words arranged into a fixed random order. They comprised a broad sample of the permissible phoneme sequences in Japanese, including nasal mora, geminate consonants and vowels and devoiced vowels, which avoided systematic relationships between the number of phonemes a word contained, and either the number of mora in that word, or the number of Kana needed to spell it. There were four VV words, eight CV words, and two VC words in the two-phoneme pool; two VVV words, four VCV words, four CVV words, and four CVC words in the three-phoneme pool, and six CVCC words, two CVVV words, two VCCV words, two VCVV words, and two VVCV words in the four-phoneme pool.

Angle counting test. The materials were simple black and white line drawings that appeared on three by five inch cards. From one to three 30° angles were embedded in each drawing and the task was to count the number of these angles. In keeping with the design of the phoneme- and mora-counting tests, there were four series of training trials; in the first three series, the items were a progressive set of simple geometric shapes, but in the fourth they were objects that bore no systematic relationship to each other. The test sequence comprised drawings of objects, seven with one angle, seven with two angles and seven with three angles, arranged in a fixed random sequence.
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Procedure

Prior to testing, the children were divided into two groups of ten girls and ten boys each. One group received the mora counting test, the other received the phoneme-counting test, and both received the angle-counting test at the onset of the session and the reading test at the end. The procedure for all three counting tests was the same. The instructor (a native speaker of Japanese) took two small hammers and told the child that they would be playing a "counting game." He then demonstrated the first training series in progressive order by saying each word in a normal fashion (or displaying each card) and then tapping the number of mora, phonemes, or angles. Next, the demonstration was repeated, with the child copying the instructor (saying each word first), and then items in the series were presented in a fixed random order, and the child responded without benefit of demonstration. If an error was made, the item was repeated and presentation of another randomized series followed. Otherwise, training proceeded to the next series, until, on completion of the fourth training series, the test items were presented and the child was instructed to "count" each item without the benefit of response feedback.

Results and Discussion

In evaluating children's responses on the mora and phoneme counting materials, two different scores were computed: the number of correct responses (as in Mann & Liberman, 1984), and a pass/fail score in which the criterion for passing was six consecutive correct responses (as in Liberman et al., 1974). Both appear in Table I along with mean age and mean reading scores for children in each group. The children who counted mora were equivalent to those who counted phonemes in terms of mean age, measures of reading ability, and performance on the angle-counting test (p>.05). However, whereas scores on the mora-counting test approached ceiling, scores on the phoneme-counting test were considerably lower, t(38)=20.20, p<.0001. In addition, all of the children had passed the mora counting test, whereas only 10% had passed the phoneme counting test. The percentage of Japanese children who passed each test can be compared with the percentage of American first graders who had passed comparable tests in Liberman et al's original study: 90% for syllable counting, and 70% for phoneme counting. Apparently, first-grade children who have been educated in the use of the alphabet tend to perform better on the phoneme counting test than those who have not. Moreover, while children who have been educated in a syllabary might do slightly better on the syllable counting test, any difference is less dramatic. At present, no strong conclusion can be reached about these differences and their implications: Different test materials were used in the two countries, and children were not told explicitly to focus on the spoken word as opposed to its orthographic representation. Both problems are surmounted in Experiment III, which employed 1) a common set of materials in the testing of Japanese and American first graders, and 2) instructions to manipulate the sound pattern of each item.

Performance on each test gave indications of the influence of knowledge of Kana. In the mora-counting test, children appeared to deduce that the task involved counting orthographic units rather than counting phonological units. The majority gave an extra "tap" to the three items that contained a mora spelled with two characters instead of one, as if they were counting the number of characters needed to spell the word, instead of the number of mora. Other, much less frequent, errors on this test involved words that contained
geminate consonants or long vowels, both of which tended to be underestimated and were missed only by the poorest readers of the group.

Table I

The Ability of Japanese First Graders to Count Mora vs. Phonemes

<table>
<thead>
<tr>
<th>SUBJECT GROUP</th>
<th>MORA COUNTING</th>
<th>PHONEME COUNTING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Phonological Counting</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean No. Correct</td>
<td>38.1</td>
<td>18.1</td>
</tr>
<tr>
<td>(Max.=42)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage Passing</td>
<td>100.0</td>
<td>10.0</td>
</tr>
<tr>
<td><strong>Angle Counting</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean No. Correct</td>
<td>11.9</td>
<td>11.8</td>
</tr>
<tr>
<td>(Max.=21)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Kana Reading Ability</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean speed (in sec.)</td>
<td>61.1</td>
<td>60.7</td>
</tr>
<tr>
<td>Mean errors (Max.=30)</td>
<td>1.6</td>
<td>1.8</td>
</tr>
<tr>
<td>Mean teacher rating (Good=1,avg.=2, poor=3)</td>
<td>1.9</td>
<td>2.0</td>
</tr>
<tr>
<td>Mean age (in months)</td>
<td>83.7</td>
<td>84.1</td>
</tr>
</tbody>
</table>

Analogous adherence to a "spelling strategy" can be found in children's responses to the phoneme-counting materials. During a post-hoc interview, some of the children reported that they had tapped the number of Kana characters needed to spell a given word, and then added one to arrive at the correct response. Use of a "kana plus one" strategy could not allow children to reach the criteria of six consecutive correct responses, but it certainly inflated the number of correct responses. Items (N=25) for which the "Kana-plus-one" strategy yielded the appropriate response were correctly counted by an average of 55% of the children (which is significantly better than chance, t(24)=2.62, p<.05). In contrast, only an average of 38% had been correct on each item (N=17) for which that strategy yielded the incorrect response (which is significantly less than the percentage of children giving correct responses to the strategy-appropriate items, t(40)=5.4, p<.001, and not significantly better than chance, p>.05).

A final concern of this experiment was the relation between performance on each counting test and the ability to read Kana. For the children who learned to count mora, the number of correct responses on the mora counting test was
significantly related to teacher ratings, $r(20) = .72$, $p < .0001$, Hiragana reading speed, $r(20) = .58$, $p < .003$, and the number of errors, $r(20) = -.47$, $p < .02$, but not to age, sex, or performance on the angle counting test. This is consistent with Amano's (1970) report that mora counting ability is related to the acquisition of the first few Kana characters by pre-school children, and extends his finding to children in the first grade who possess considerably greater knowledge of the Kana syllabary. For the children who learned to count phonemes, the number of correct responses on the phoneme counting test was also significantly related to teacher ratings, $r(20) = .56$, $p < .005$, reading speed $r(20) = .65$, $p < .001$, and reading errors, $r(29) = -.57$, $p < .004$, but not to age, sex, or angle counting performance.

Thus it would appear that performance on the phoneme counting test is related to the ability to read Kana even though Kana does not represent phonemes in any direct way. As both phoneme and syllable counting performance are related to the ability to read Hiragana, just as they are related to the ability to read an alphabet, it is tempting to posit a general capacity for phonological awareness that is related to experience in reading any phonologically-based orthography. This capacity need not be part of general intelligence, given the results of some recent studies of American children (Mann & Liberman, 1984; Stanovich et al., 1984b), and the present finding that there is no significant correlation between measures of reading ability and performance on the angle counting test. It could be a general product of learning to read a phonological orthography rather than the cause of reading success, commensurate with children's reliance on Kana-based strategies. We will return to these issues in the final discussion.

The results of Experiment I are consistent with previous reports that awareness of phonemes depends on the experience of learning to read an alphabet, insofar as the majority of children could not pass the phoneme counting test. Nonetheless, two of the Japanese children did pass the test and our post-hoc interviews with them indicated that they had received no instruction in the alphabet either at home, school, or "juku" (i.e., afternoon training programs). Thus, while there may be some facilitating effects of learning a syllabary on awareness of both phonemes and syllables, some other factors may lead to individual variations. As a further test of the view that awareness of phonemes depends on the experience of learning to read an alphabet, we now turn to Experiment II, which focused on the phoneme counting ability of Japanese children in the third through sixth grades, comparing children at different grade levels in normal and "re-entering" classrooms.

**Experiment II**

**Method**

**Subjects**

The subjects were children attending the normal third- through sixth-grade classes and the special "re-entry" class at Ochanomizu University. The "normal class" subjects included 64 children in the third and fourth grades, and 32 children in the fifth and sixth grades. The "re-entry class" subjects included 13 fourth graders, 14 fifth graders, and 12 sixth graders, all of whom had learned to read either the English or German alphabet. Approximately equal numbers of boys and girls were included in each group and all served with parental permission. They were tested during the second trimester of
school, so that children in the normal fourth-grade classes had not yet received training in the alphabet. Consultation with the teachers, the principal, and the children themselves confirmed that none of the subjects in normal classrooms had received instruction in the alphabet at school, home or "juku".

Materials and Procedure

The materials were the mora- and phoneme-counting materials employed in Experiment I, administered by the same instructor. For convenience, the procedure was adapted for group testing, in which case an entire class of children received the basic instructions and practice items with feedback, and learned to "count" each word by drawing slashes through the appropriate number of boxes in a five-box answer grid instead of by tapping the number of syllables/phonemes with a hammer. As in Experiment I, feedback was provided during training, but no feedback was provided during presentation of the test items. To insure the feasibility of group testing, the mora-counting materials were administered as a control measure to 32 of the third graders and 32 of the fourth graders. All of the remaining subjects received the phoneme-counting materials.

Results and Discussion

The data were scored in the manner of Experiment I, by computing both the number of correct responses and a pass/fail score. The results obtained from the mora-counting materials indicate the utility of the group testing procedure, as all of the third- and fourth-grade children had passed criterion with mean scores of 38.7 and 39.0, respectively. They also attest to the continuing power of the Kana orthography to mold the Japanese child's concept of language: As was the case in Experiment I, almost all of the children had made errors on the three test words in which the number of kana characters needed to spell the word surpasses the number of mora it contains.

Performance on the phoneme counting test is summarized in Table II, according to the age of the subjects, and whether they were in the normal or re-entry classes. On the basis of previous findings that alphabet-illiterate adults are not aware of phonemes, it might be expected that normal Japanese third and fourth graders would be no more aware of phonemes than the Japanese first graders studied in Experiment I, whereas the normal fifth and sixth graders and all of the re-entry students would be comparable to the American first graders studied by Liberman et al (1974). Yet, the data fail to uphold that prediction. First, for children in the normal classrooms, whose data appear in the upper portion of Table II, the only marked improvement in phoneme counting scores occurs between the third and fourth grades, prior to any instruction in the alphabetic principle. There is also no sharp spurt in the awareness of phonemes between fourth and fifth grades (p>.05), such as would be expected if instruction in the alphabet were critical. Second, fourth graders in the reentry group performed at the same level as their peers in the normal classrooms (p>.05), despite the fact that they alone had learned to read an alphabet. Third, and finally, the proportion of Japanese fourth graders who had passed criterion is comparable to that among the American children in Liberman et al.'s (1974) study, despite the fact that the Japanese children had not yet learned to read the Romaji alphabet.
Table II
Phoneme Counting Ability Among Japanese Children in the Third to Sixth Grades: Normal vs. Reentering Students

<table>
<thead>
<tr>
<th></th>
<th>Third</th>
<th>Fourth</th>
<th>Fifth</th>
<th>Sixth</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Normal students</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean No. Correct (Max.=42)</td>
<td>21.5</td>
<td>30.3</td>
<td>31.2</td>
<td>31.5</td>
</tr>
<tr>
<td>Percentage Passing</td>
<td>56.2</td>
<td>73.5</td>
<td>81.3</td>
<td>75.0</td>
</tr>
<tr>
<td>Age (in months)</td>
<td>108.5</td>
<td>120.1</td>
<td>131.2</td>
<td>143.7</td>
</tr>
<tr>
<td><strong>Reentering students</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean No. Correct (Max.=42)</td>
<td>---</td>
<td>27.2</td>
<td>28.6</td>
<td>27.7</td>
</tr>
<tr>
<td>Percentage Passing</td>
<td>---</td>
<td>60.0</td>
<td>60.0</td>
<td>80.0</td>
</tr>
<tr>
<td>Age (in months)</td>
<td>---</td>
<td>118.9</td>
<td>132.7</td>
<td>144.4</td>
</tr>
</tbody>
</table>

As in Experiment I, the importance of orthographic knowledge is illustrated by the pattern of errors, which suggests that at least some children were relying on the "Kana-plus-one" strategy of counting the number of characters needed to spell the word, and then adding one. Children at all ages tended to be most successful on items for which this strategy yielded the correct response: for strategy-appropriate items the average percent correct was 58%, 80%, 81%, and 82%, for third through sixth graders, respectively, whereas that for the strategy-inappropriate items was 42%, 56%, 64%, and 67%, respectively. Here, however, performance on both types of items surpassed the chance level of 33% correct (p<.05), suggesting that appreciably many children at each age had been counting phonemes.

A popular organization of the Kana syllabary places the characters in a grid with the vowel mora in a different column to the far right of those containing characters for other mora. This organization had led us to anticipate that some of the subjects in Experiments I and II would use a strategy of giving the vowel mora one count and all other mora two counts. However, in post-hoc interviews of our subjects we found that none of them described such a strategy. Likewise, none of the children reported special treatment of the kana that can receive diacritics to mark the voicing of an initial stop consonant or fricative. Certainly it is possible that knowledge of Kana may have in some other way provoked children to reflect on the internal structure of words and thereby promoted phoneme awareness, but we were unable to determine why. Although children master Kana by the very early stages of first grade, the sharpest increase in phoneme counting performance occurs between third and fourth grade. Either increased experience of a very general sort or some maturational factors could be responsible.

In summary, although the findings of Experiment I suggest that both phoneme and syllable counting ability in the first grade might be facilitated by knowledge of an orthography that transcribes language at the level of that
unit, the findings of Experiment II suggest that, analogous to the many American children who become aware of syllables by age six without having learned to read a syllabary, many Japanese children may become able to count phonemes by age nine or ten, despite a lack of formal instruction in the alphabet. Moreover, at that age, training in the use of an alphabet does not particularly enhance the ability to count phonemes. This finding stands in contrast to findings that most alphabet-illiterate adults appear to lack an awareness about phonemes.

One possible explanation of the performance differences between alphabet-illiterate adults and Japanese children is that they reflect task differences rather than differences in phonological awareness, per se. Japanese children might appear to be more aware of phonemes because the counting tasks employed in Experiments I and II were not explicit as to whether "sounds" or characters were to be counted, leading to reliance on a Kana-based strategy that inflated the number of correct responses. However, use of such a strategy could not account for changes in the percentage of children who passed the phoneme counting test, which raises the possibility that children passed the test because it provided a less conservative measure of phoneme awareness than the deletion tasks used in studies of adults. The results of at least one study are commensurate with this latter possibility. Performance on counting tasks and deletion tasks emerged as separate factors in a study of the relation between phonological awareness and the reading progress of semi-literate adults enrolled in a remedial reading class (Read & Ruyter, 1985). Another study, however, reveals that task-differences are not of critical importance to the relation between phonological awareness and the future reading success of kindergarten children in America (Stanovich et al., 1984a). However, as this latter study did not include counting tests, it remains a possibility that performance on counting tasks involves a more accessible level of phonological awareness than performance on deletion tests, hence the apparently greater awareness of phonemes on the part of Japanese children relative to alphabet-illiterate adults.

If the above explanation is correct, the present findings should not extend to use of a deletion test. On such a test, Japanese children should behave as poorly as alphabet-illiterate adults. With this prediction in mind, we turn to Experiments III and IV, which attempted to replicate Experiments I and II with deletion tasks analogous to those employed by Morais et al. (1979) and by Read et al. (1984). Two sets of nonsense-word materials were designed, one for phoneme deletion and one for mora deletion. Nonsense words had been among the most difficult items for the adult subjects and therefore offer a maximally conservative measure of children's performance; they also permit parallel testing of Japanese and American children.

Experiment III

Method

Subjects

The subjects were 40 Japanese first graders and 40 American first graders. There were equally as many girls as boys, all of whom served with parental and teacher permission. The Japanese children were drawn from an available population of children who had not participated in Experiment I. Mean age was 84.4 months at the time of testing, which was midway through the second trimester of the school year. The American children were comparable in age
and SES, and were attending the Bolles Primary School in Jacksonville, FL. Mean age was 84.1 months at the time of testing, which was early in the second semester of the school year. Measures of children's reading ability were obtained by having the teachers rate each child as good, average, or poor in reading ability, and by giving each child a test of word decoding skill: the Hiragana reading test described in Experiment I for Japanese children, and the Word Identification and Word Attack Subtests of the Woodcock Reading Mastery Test (Woodcock, 1973) for American children.

Materials

As in Experiment I, two parallel sets of materials were designed, one for assessing syllable deletion ability and one for assessing phoneme deletion ability. The design of each was prompted by the methodology of Morais et al. (1979) and Read et al. (1984): Each set of materials assessed deletion of two different tokens of the segment of interest, with blocked sequences of training items followed by test items. To make the items suitable for use in English and Japanese, it was necessary that they contain only those Japanese mora that bear a one-to-one relationship to English syllables. Thus, all items contained consonants and vowels shared by the two languages, and none of them contained long vowels, syllabic [n], geminate consonants, diphthongs, consonant clusters, or syllable-final consonants. Each test item, and the item formed by removing its initial mora (or phoneme, as appropriate), was judged to be meaningless in Japanese (by the informants who judged the items of Experiment I) and in English (by comparable English-speaking informants).

Syllable materials. These materials assessed children's ability to remove an initial syllable (mora), [ta] or [u], from a three-syllable/three-mora nonsense word. Twenty items started with [ta] and twenty with [u]; the second and third syllable of each word varied freely. For the purpose of testing, the items were blocked with respect to initial syllable, and each block was subdivided into ten practice items and ten test items.

Phoneme materials. These materials assessed children's ability to remove an initial phoneme, [/ʃ] or [k], from a four- or six-phoneme (i.e., two or three syllables/mora) nonsense word. Twenty items started with [/ʃ] and twenty with [k]. The second phoneme of each word was always one of the five permissible vowels such that, across the items, each initial phoneme was followed by each vowel once in a four-phoneme word, and once in a six-phoneme word, with the remaining portion of each item varied freely. For the purpose of testing, the items were blocked with respect to initial phoneme, and each block was divided into ten practice items and ten test items (such that two- and three-syllable words were equally divided between practice and test items, as were the five vowels that could occur in the second-phoneme position).

Procedure

Children were tested individually by native speakers who used comparable instructions in the two languages. Within each country, half of the children received the syllable deletion test, half received the phoneme deletion test, and all received the reading test at the conclusion of the session. For each deletion test, presentation of practice and test trials was blocked with respect to initial segment (i.e., [ta] or [u], [/ʃ] or [k]) with order counterbalanced across subjects. The instructor explained that the task
involved repeating a word and then trying to say it without the first sound. He or she then proceeded to demonstrate the first five practice items: saying each word, repeating it, and then saying it without the first syllable or phoneme. Next, each of these was repeated and the child was requested to imitate the instructor by repeating the item and then saying it "without the first sound." Then the final five practice items were administered without benefit of demonstration, but with response feedback. Completion of the practice items was followed by the ten test items, which were administered without response feedback. Completion of the first block of trials was followed immediately by presentation of the second block of training and test items.

Results and Discussion

Attempts to remove the initial segment from each item were scored as correct or incorrect. The mean number of correct responses appear in Table III, separately for the American and Japanese children, according to the type and token of the segment being manipulated. When averaged across tasks and tokens, the scores of American children are slightly superior, $F(1,76)=7.31$, $p<.009$. With regard to the type of segment being deleted, children in both

<table>
<thead>
<tr>
<th>Table III</th>
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<tr>
<td><strong>Mora (Syllable) Elision Ability vs. Phoneme Ability:</strong> A Comparison of First Graders in Japan and America</td>
</tr>
<tr>
<td><strong>Japanese Children</strong></td>
</tr>
<tr>
<td><strong>Mora Group</strong></td>
</tr>
<tr>
<td>Mean No. Correct: 9.15</td>
</tr>
<tr>
<td>(Max. = 10, Age = 85.1 mo.)</td>
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<tr>
<td><strong>American Children</strong></td>
</tr>
<tr>
<td><strong>Syllable Group</strong></td>
</tr>
<tr>
<td>Mean No. Correct: 8.90</td>
</tr>
<tr>
<td>(Max. = 10, Age = 83.5 mo.)</td>
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</table>

countries found the phoneme deletion task more difficult than the syllable (mora) deletion one, $F(1,76)=87.64$, $p<.0001$. However, the extent of difference between scores on the two tasks was greater for the Japanese children, $F(1,76)=13.01$, $p<.0006$. As compared to the American children, the Japanese children received higher scores on the syllable deletion task, $t(38)=2.73$, $p<.05$, but lower scores on the phoneme deletion task, $t(38)=-4.09$, $p<.01$. There were no significant effects of token differences, nor interactions between this manipulation and other factors.
A further analysis considered the relations between phoneme and syllable deletion performance (summed across tokens) and reading ability in each country. As anticipated by the results of Experiment I, the mora deletion performance of the Japanese children was related to the speed, $r(20) = .69$, $p < .001$, and number of errors made on the Hiragana test, $r(20) = .72$, $p < .001$, and also to the teacher's ratings of reading ability, $r(20) = .54$, $p < .005$. Likewise, their phoneme deletion ability also proved to be related to speed, $r(20) = .37$, $p < .05$, and errors on the Hiragana test, $r(20) = .38$, $p < .05$, and to teacher ratings, $r(20) = .47$, $p < .02$. For the American children, phoneme deletion ability was related to the sum of raw scores on the Woodcock tests, $r(20) = .61$, $p < .005$, and to the teacher's ratings, $r(20) = .57$, $p < .008$, but syllable deletion ability was not related to either measure of reading ability. In neither language community was the age or sex of the first graders related to reading ability, mora deletion ability, or phoneme deletion ability ($p > .1$).

The relative superiority of the American children in the case of the phoneme deletion task corroborates previous indications that awareness about phonemes is facilitated by the learning of an alphabetic orthography. The analogous finding that Japanese children perform at a superior level on the syllable deletion task suggests that awareness about syllables may be likewise facilitated by learning to read a syllabary. Nonetheless, the finding that both Japanese and American children achieved higher levels of performance on the syllable deletion test than on the phoneme deletion test suggests that the ability to read a syllabary is less critical to awareness about syllables than the ability to read an alphabet is to awareness about phonemes. We now turn to Experiment IV, which attempted to replicate the findings of Experiment II regarding the contribution of orthographic knowledge to the phoneme deletion performance of Japanese children in normal fourth- and sixth-grade classrooms.

Experiment IV

Method

Subjects

The subjects were 20 fourth graders and 20 sixth graders attending the normal classes of the Ochanomizu Elementary School. Ten boys and ten girls from each grade were chosen at random from among the available pool of children who had not participated in Experiment II (i.e., those whose only experience with alphabetic instruction had occurred in school). All served with teacher and parental permission. Testing was conducted during the first trimester of the school year such that only the sixth graders had been educated in the use of an alphabetic orthography. Mean ages for each group were 117.1 and 142.5 months, respectively.

Materials and Procedure

The materials and procedure for Experiment IV were the phoneme deletion materials employed in Experiment III. The only innovation was that, at the completion of the test session, each subject was given two of the test items to which he or she had responded correctly and was asked to explain how the correct response had been derived. This provided a test of whether subjects had relied on either a Kana-based or a Romaji-based spelling strategy.
Results

The mean number of correct responses appears in Table IV, separated according to grade level and the phoneme token ([f] or [k]) being manipulated. It can be seen that the performance of the sixth graders surpassed that of the fourth graders, \( F(1,38) = 18.49, p<.0001 \), consistent with the fact that only the sixth graders had learned to use alphabetic transcription. When the present results were compared with those obtained in Experiment III (and shown in Table III), it was found that both the Japanese fourth and sixth graders had surpassed the Japanese first graders in mean performance on the phoneme deletion task, \( t(38)=4.08, p<.01 \) for fourth graders, and \( t(38)=4.53, p<.01 \) for sixth graders. The Japanese fourth graders performed at the same level as the American first graders \( (p>1) \), and the Japanese sixth graders had actually surpassed them, \( t(38)=5.11, p<.01 \).

<table>
<thead>
<tr>
<th>Grade in School</th>
<th>Phoneme Elision Performance Among Older Japanese Children</th>
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<tr>
<td></td>
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<tr>
<td>Fourth Grade</td>
<td>Mean No. Correct:</td>
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<tr>
<td></td>
<td>(Max. = 10, Age = 117.1 mo.)</td>
</tr>
<tr>
<td>Sixth Grade</td>
<td>Mean No. Correct:</td>
</tr>
<tr>
<td></td>
<td>(Max. = 10, Age = 142.5 mo.)</td>
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</table>

To gain some appreciation of the Japanese children's knowledge of Romaji, we conducted an informal post-hoc interview with the five children who performed the best at each grade level. We found that none of the fourth-graders could read the nonsense test materials written in Romaji, whereas three of the sixth graders could do so. In contrast, although we had not asked the American children to try to read the test materials, they had been able to read an appreciable number of nonsense words on the Woodcock word-attack test. It may be remembered that the Japanese fourth graders had not received any instruction in Romaji, whereas the sixth graders had received approximately four weeks of instruction a full year and a half prior to the test session. The American first graders, on the other hand, had been receiving intensive phonics-based instruction in the use of the English alphabet for more than six months immediately prior to the test session.

A further analysis reveals an effect of token variations: Both fourth and sixth graders tended to give more correct responses to items that began with [k] than to those that began with [f], \( F(1,38)=20.73, p<.0001 \). This may be explained by hypothesizing a "character-substitution" strategy based on the previously mentioned grid for representing the Kana syllabary as a matrix of rows and columns in which mora that share a vowel lie in the same row, and those that share a consonant lie in the same column. Within that matrix, the character for [a] is to the immediate right of that for [ka], [i] is to the immediate right of [ki], [u] to [ku], etc. Thus, children might be tempted to spell a word by replacing the first character with the character that lies to its immediate right on the matrix. Use of this strategy could cause [k] to be
easier to delete than [ʃ] because characters containing [k] are immediately adjacent to those for isolated vowels, whereas most that contain [ʃ] are spelled with the character for [ʃi] with a subscripted character for [ya], [ye], [yu] or [yo] (according to the identity of the vowel). Moreover, they lie at the opposite end of the grid from the vowel characters, making it less obvious how to derive the character for the relevant vowel from that which represents the CV.

In this regard, we had actually asked children to explain how they had been able to arrive at a correct response. Of the fourth graders, seven were unable to describe their strategy at all, nine gave evidence of using the "character substitution strategy," and four subjects described a "phonological" strategy that more or less amounted to doubling the vowel of the first syllable in a word and then removing the initial consonant-vowel portion (i.e., making [ki-pi] into [ki-i-pi], and then deleting [ki] to yield [i-pi]). The children who reported the "phonological strategy" had achieved some of the best scores in their age group, and they tended to be equally accurate in their responses to items containing [k] and [ʃ]. As for the sixth graders, all of whom had been exposed to the alphabet, only four appeared to have employed the "character substitution strategy", and they achieved some of the lowest scores in their age group especially for items that began with [ʃ]. Fifteen of the remaining children reported some version of the "phonological strategy," and only a single child reported a strategy of using Romaji.

General Discussion

The present study asked whether Japanese children's awareness of syllables and phonemes differs from that of American children, as a consequence of their having learned to read a syllabary instead of an alphabet. The results clearly showed that Japanese children's approach to phonological counting and deletions tests is influenced by their reading experience. Knowledge of the Kana syllabary tended to confound performance on tasks that attempted to assess ability to manipulate phonological units, whether the tasks involved counting or deleting phonemes or syllables, and whether the instructions were ambiguous or explicit as to whether orthographic or sound units were being counted. Younger children in particular tended to manipulate the characters that spell a word rather than the phonological units that the characters transcribe. This tendency has previously been observed among American children (Ehri & Wilce, 1980) and has been one form of evidence that knowledge of an alphabet is responsible for phoneme awareness.

The results further reveal performance differences between first graders in Japan and America and illustrate that knowledge of a syllabary/logography as opposed to an alphabet can have a very specific effect on phonological awareness. Relative to first graders in Japan, first graders in America can more accurately count the number of phonemes in words and can more accurately remove the initial phonemes from nonsense words. Thus, the experience of learning to read an alphabet must facilitate children's awareness of phonemes at this age. The analogous finding that Japanese children can surpass American children in performance on tasks that call for syllable manipulation likewise reveals that experience with a syllabary can facilitate the awareness of syllables. However, children, in general, find syllable manipulation an easier task than phoneme manipulation, which suggests that the experience of learning to read a syllabary vs. an alphabet is not the sole determinant of phonological awareness.
What might the other determinants be? First of all, the development of phonological awareness may be a multi-faceted process that depends on the abstractness of the unit at issue. Syllables, as compared to phonemes, are isolable acoustic segments; they are more superficial, less encoded components of the speech signal. Thus it is reasonable that syllable awareness should be an easier, more natural achievement of such factors as cognitive maturation and primary language development, requiring less special cultivating experience than awareness of phonemes. The results of previous research favor this view (Liberman et al., 1974; Alegría et al., 1982; Read et al., 1984). While awareness of syllables may be a precursor of awareness of phonemes, it is not sufficient, given that some individuals can manipulate syllables but not phonemes. Previous research had suggested that the ability to manipulate phonemes depends on knowledge of an alphabet (Byrne & Lebed, 1986; Liberman et al., 1985; Morais et al., 1979; Read et al., 1984), but the present study suggests that other factors can also play a role.

The findings of Experiments II and IV emphasize the role of factors other than knowledge of the alphabet in the development of phoneme awareness, by revealing that, whereas most Japanese first graders could manipulate syllables but not phonemes, the majority of Japanese children were able to manipulate both syllables and phonemes by the fourth grade, whether or not they had been instructed in the use of an alphabet. Thus, with increasing age and educational experience, Japanese children may become more and more capable of manipulating phonemes whether or not they are alphabet-literate.

This finding stands in contrast to previous reports that adults who do not know how to read an alphabet are not aware of phonemes, and some explanation is required. We may disregard the possibility that the differences between Japanese children and the alphabet-illiterate adults are due to task differences rather than differences in phonological awareness, per se. A concern with this possibility prompted Experiments III and IV, which employed deletion tasks analogous to those used in previous studies of illiterate adults. The results obtained in these experiments are much the same as those obtained with the counting tasks employed in Experiments I and II. This accords with some other observations that the task-unique cognitive demands posed by different tests of phonological awareness do not appreciably confound conclusions about young children's phonological awareness and its role in reading acquisition (Stanovich et al., 1984a).

Perhaps a more reasonable interpretation is to accept the differences between the present findings and those obtained with alphabet-illiterate adults as differences in phonological awareness. We might then explore the possibility that other types of secondary language activity are responsible for the superior phonological awareness of the older Japanese children. One clear likelihood is that awareness of both syllables and phonemes is promoted by the experience of learning Kana, owing to the fact that it is a phonological orthography. This accords with the fact that many of the adults who proved deficient in phoneme awareness were functional illiterates (i.e., the American and Portuguese adults). It would also accord with the correlations between Kana reading ability and both syllable and phoneme awareness, observed in Experiments I and III (although the correlation leaves causality ambiguous). It might seem inconsistent with certain findings (i.e., Experiment III and Mann, 1984) that syllable awareness fails to correlate with the ability to read the alphabet, but ceiling effects are a possible confounding factor. Other studies, however, have reported a correlation.
between syllable awareness and reading ability (see, for example, Mann & Liberman, 1984; Alegria et al., 1982).

A more serious problem with the view that knowledge of a phonological orthography promotes all aspects of phonological awareness concerns the lack of phoneme awareness among adult readers of the Chinese orthography (Read et al., 1984). As noted by Gelb (1963), Chinese, the most logographic of all the writing systems, is not a pure logographic system because from the earliest times certain characters have represented not words but phonological units. Many Chinese characters, the "phonetic compounds," are composed of a radical and a phonetic, each of which otherwise represents a word of the language. As noted by Leong (in press), the "fanqui" principal has been employed since 600 A.D. for decoding phonetic compounds, a strategy that calls for blending the first part (initial consonant) and the tone of the word represented by the phonetic with the final part (syllable rhyme) of the word represented by the radical. Thus a compound, e.g., composed of "t'uu" and "l'iau," decodes as "t'iau." Several Chinese colleagues inform me that classical methods of education in the Chinese logography have explicitly called the reader's attention to the phonetic components. Moreover, although phonological changes have necessarily altered the relationship between phonetic compounds and the words they represent, one recent study reveals that the adult readers of Chinese make use of the phonetic insofar as they name low-frequency (but not high-frequency) characters that involve phonetic compounds faster than non-phonetic compound characters (Sleidenberg, 1985). Likewise, adult readers of Chinese can use phonetic radicals productively (Fong, Horne, & Tzeng, 1986), to give consistent pronunciations for nonsense logographs composed of radicals and phonetics that do not co-occur. Given these findings, it is somewhat puzzling that exposure to phonetic compounds did not promote phonological awareness among Read et al.'s subjects, if exposure to any phonological orthography facilitates phoneme awareness.

Putting aside the role of reading experience, it is possible that phoneme awareness is facilitated by some other secondary language experience that is available to Japanese children but not to the adults studied in Portugal and China. For Japanese children, the appropriate experience might involve learning to analyze or manipulate the phonological structure of spoken words while playing word games like "Shiritori" or while learning about Haiku. That the experience facilitating phonological awareness need not be limited to reading is evident from previous findings about the utility of explicit training in phonemic analysis (see Treiman & Baron, 1983, for example). Exposure to nursery rhymes and other poetry, for example, could help to explain why many American children are aware of syllables before they learn to read. But it would have to be argued that experience with such secondary language activities facilitates the development of all aspects of phonological awareness in a very general way, else how are we to explain the fact that Japanese children became able to manipulate phonemes despite a lack of experience with games and versification devices that directly manipulate phoneme-sized units? Even if it is postulated that any secondary language experience that manipulates phonological structure can give rise to awareness of both syllables and phonemes, there remains a problem insofar as meter and rhyme are exploited by both Chinese and Portuguese verse, song lyrics, etc., and would probably have been available to the illiterate adults who nonetheless lacked phoneme awareness. A further problem arises from the fact that, in the present study, all of the children were familiar with the Kana syllabary and the same types of word games and versification devices, yet only
a small minority of the first graders (10%) were able to count phonemes, whereas the majority of fourth graders could do so.

A similar argument can be made against the view that Japanese children knew about phonemes because they had seen signs, labels, etc. written in the Romaji alphabet. Any explanation that passive exposure to the Romaji alphabet is responsible for the phoneme awareness of Japanese children would have to account for the fact that all children are exposed to Romaji signs and logos, yet only those aged nine and older had profited from that exposure. It would also have to account for the fact that passive exposure to alphabetically-written material failed to promote phoneme awareness among the Portuguese adults studied by Morais et al. (1979).

One final explanation of the differences between the present results and those obtained with alphabet-illiterate adults remains. The ability to manipulate both syllable and phoneme-sized units could be a natural concomitant of primary language development that is exploited by many secondary language activities such as reading, versification, and word games. But if this capacity is a natural concomitant of primary language, how can it be deficient in alphabet-illiterate adults? Perhaps the ability to manipulate phonemes tends to atrophy unless maintained by appropriate reading experience. It has often been speculated that children acquire their primary language with the aid of a language acquisition device that is not present in adults. That the capacity for manipulating phonemes could be part and parcel of a language acquisition device follows from a suggestion made by Mattingly (1984), in answer to the question of why readers might be able to gain access to the otherwise reflexive processes that support the processing of phonological structure in spoken language. He suggests that an ability to analyze the phonological structure of spoken words might serve to increase the language learner's stock of lexical entries, and this, together with some other evidence that children have a privileged ability to acquire new lexical entries (Carey, 1978), could lead to the speculation that children have a privileged ability to manipulate phonological structure that somehow facilitates their ability to engage in secondary language activities that involve manipulations of phonological units. The prevalence of this capacity in childhood could promote children's acquisition of phonological orthographies during their elementary school years and by postulating that this capacity in the absence of appropriate orthographic knowledge, one might explain the lack of phoneme awareness observed among alphabet-illiterate adults. However, this view is not without its problems, one being the fact that Japanese children could not do well on either the counting or elision tasks until relatively late in their childhood. Here, the cognitive demands of tests that are used to measure phoneme awareness and the confounding role of orthographic knowledge cannot be disregarded. Ongoing research with a broader battery of tests and a broader range of ages may further elucidate the basis of phonological awareness in the interplay between cognitive skills, primary language skills, and experience with secondary language activities such as reading.

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