

## Effects of Mnemonics on Immediate and Delayed Recalls of Hiragana by Learners of Japanese as a Foreign Language

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This paper reports a study which investigated the short-term and long-term effects of picture and sound mnemonics on remembering hiragana by learners of Japanese as a foreign language (FL). The study tested two hypotheses. One was that FL learners of Japanese, with or without prior experience in learning non-Roman scripts as their L1, would not benefit from the picture-plus-sound mnemonics on the immediate recall test. The other was that those learners without such experience (the Roman group) would benefit from these mnemonics on the delayed recall test while those learners with such experience (the non-Roman group) would not benefit.

In this study, 66 beginning learners of Japanese at an American university participated in four computer-generated tutorial sessions of 40 hiragana. In each session, one of the four sets of ten hiragana was introduced in one of the four teaching methods: (a) picture and sound mnemonics (P + S), (b) picture mnemonics (P), (c) sound mnemonics (S), and (d) flash cards (F). Each session consisted of (a) a learning phase, (b) a review phase, and (c) a self-test phase. Each session was followed immediately by an oral interview and by recall tests two to five days later.

The analyses of valid data from 50 participants on the self-test half supported the first hypothesis; the P + S method was effective only for the Roman group. The analyses of valid data from 45 participants on the delayed recall test also half supported the second hypothesis; the P + S method was not effective for either group. The results from both tests are discussed in relation to a previous study (Quackenbush, Nakajo, Nagatomo, and Tawada, 1989) and transfer of L1 script recognition strategies (Chikamatsu, 1996; Koda, 1989; Mori, 1998). In addition, an observation is made as to why the P + S method was effective, and future studies are suggested.

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When learning a large amount of new information, such as a foreign language, mnemonics are said to be a useful tool, for they function as “memory aids” (Higbee, 1977) that relieve the burden on learners’ short-term memory by associating the new information with something familiar (Ericsson, Chase, and Faloan, 1980). There are various mnemonic techniques used in foreign-language learning (Paivio and Desrochers, 1981, for review), but the one that is most widely used is called the “keyword method,” originally developed by Atkinson (1975) to teach foreign language vocabulary.

The process involved in the keyword method is best explained by the “three Rs” (Mastropieri and Scruggs, 1991: 10), which stand for “reconstructing,” “relating,” and “retrieving.” For example, when English speakers learn an Italian vocabulary item “ranid” meaning “frog,” a similar-sounding keyword “rain” which is concrete and familiar to the learners, is first reconstructed. Once the keyword (rain) has been reconstructed and learned, it must then be related to the to-be-learned information (frog). This is done by combining “rain” and “frog” in a sentence, a visual image, or a picture (e.g., a frog sitting in the rain). When the learners attempt to retrieve the English definition of “ranid,” they think of the keyword (rain), think back to the interactive picture that contained the keyword and its definition (a frog sitting in the rain), and then retrieve the definition from the information in the picture (frog).

Empirical support for the effectiveness of mnemonics including the keyword method, however, is mixed not only in learning European languages (Cohen, 1987, for review), but also in learning non-European languages, such as Chinese, especially on long-term retention of the learned information. Lu, Webb, Krus, and Fox (1999) and Wang and Thomas (1992), for example, investigated the effectiveness of imagery-based mnemonics (i.e., presenting an English explanation of a character construction [e.g., 明 ‘bright’ = 日 ‘sun’ + 月 ‘moon’]) in teaching Chinese characters to native speakers of English. Whereas Lu et al. found their effectiveness in contrast to the rote memory method (presenting a character with English translation [e.g., 明 ‘bright’]) on both immediate and delayed recalls of the English meanings of the characters, Wang and Thomas found the same only on immediate recall (Experiment 1). As Cohen has pointed out, because in most of the mnemonic studies including those by Lu et al. and Wang and Thomas, the participants were not actual learners of the target language, thus the motivation factor might have played a role in producing different results.

As for Japanese, the use of picture and sound mnemonics is a common method in teaching hiragana (Japanese syllabic symbols) as a second language (L2) or a foreign language (FL). In fact, there are many books (e.g., Hijirida and Dung, 1992; Makino, Hatasa, and Hatasa, 1998; Ogawa, 1990; Quackenbush and Ohso, 1983; Rowley, 1995) as well as a computer program (Hatasa, Kaga, and Henstock, 1992) that provide picture mnemonics (e.g., a picture of a key that simulates the shape of き which stands for /ki/) with sound cues (e.g., /ki/ as in /key/) to teach hiragana to L2/FL learners of Japanese. Despite the popularity of this mnemonic method in teaching hiragana, there is only one published study that investigated its effects on

learning the symbols (see Appendix for 46 hiragana and their sounds).

The study was conducted by Quackenbush, Nakajo, Nagatomo, and Tawada (1989). In this study, two groups of L2 learners of Japanese at the beginning level (16 nonnative but proficient speakers of English whose first language [L1] did not employ non-Roman scripts [Chinese characters]) were taught 46 hiragana using two different methods. One was the conventional mnemonic method described above, and the other was a flashcard method in which each card showed a hiragana symbol with colored lines signaling its syllabic sound. For example, on a card on which the hiragana that stands for /ka/ was written, a brown horizontal line was drawn above the hiragana and a black vertical line on the right side of it; apparently the brown line was to be associated with the consonant /k/ and the black line to be with the vowel /a/.<sup>1</sup>

In the Quackenbush et al. study, these two methods were employed with two groups of students, and three sessions were completed with each group within 50 minutes in class. There was an introductory session of 46 hiragana (explanation of the syllabic nature of hiragana), a teaching session of these hiragana (using two different methods with two different groups), and a practice session (reading practice with flashcards and the hiragana chart [shown in Appendix]). Both groups were given a pretest (writing the sounds of hiragana in Roman letters) before class, a recall test (the same as the pretest) immediately after class, and a recognition test (matching between the sounds and the hiragana) four days after class. The pretest showed that both groups had known at least half of the 46 hiragana, and the immediate recall test showed that both groups gained equally from the two methods. It is only on the delayed recall test that the mnemonic method group performed significantly better than the flashcard method group.

The difference between the results on the immediate recall test and those on the delayed recall test in Quackenbush et al.'s study could be explained by multiple factors. The first, as pointed out by the researchers, is that on the immediate recall test, the flashcard group could skillfully have used the order information indicated with different colors. In other words, since all of the symbols except *ん* /N/ were color coded on the cards seen by this group, they could mentally have arranged the symbols in the chart (Appendix) by using the color information at the learning stage, and on the test they could have figured out the sounds of the given symbols by locating them in the mentally imagined chart. Second, on the immediate recall test, the participants were required to recall the sounds and write them in Roman letters for the given symbols, while on the delayed recall test, they were required only to match the sound they heard with one of the five hiragana. The recognition task on the latter test might have been easier than the recall task on the former test. Third, their participants were encouraged to review hiragana during the three days between the immediate recall test and the delayed recognition test. The extra practice

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<sup>1</sup> According to Quackenbush et al. (1989: 156), the colors for the vowels were chosen to provide hints for the pronunciations: "black" for /a/, "green" for /i/, "blue" for /u/, "red" for /e/, and "orange" for /o/.

might have made a difference in their results. Without knowing how and how long practice was done by the two groups, it is not clear whether the results obtained on their delayed recall test are purely due to the mnemonics. It would certainly be interesting and necessary to conduct a study to see whether the same results could be obtained from FL learners of Japanese (including native speakers of English)<sup>2</sup> with little knowledge of hiragana, by using the consistent task on the two tests, and by blocking the use of order information of the hiragana chart and the influence of practice between the tests.

Another motivation for conducting mnemonic research in teaching and learning hiragana as FL is to know whether there would be any performance difference between those who have prior experience with learning non-Roman scripts in their L1 and those who do not. In Quackenbush et al.'s study, those whose L1 employed non-Roman scripts (Chinese characters) were not included as their subjects without explanation. One reason could be that the researchers assumed that these learners' recognition strategies would differ from those used by learners whose L1 employs Roman scripts. In fact, prior research in the role of transfer of strategies from subjects' L1 learning experience has shown that it plays a positive role in word recognition at the beginning stage of learning Japanese as FL. For example, Chikamatsu (1996) asked elementary-level learners of Japanese, whose native languages were Chinese or English, to perform kana-word (words written in hiragana and katakana, two sets of Japanese syllabic scripts) identification tasks. Her hypothesis was that due to the difference in the type of L1 orthography between Chinese and English, these learners' recognition strategies of kana words would differ. The results indicated, in support of her hypothesis, that Chinese speakers, being "logographic readers," relied more on visual information than did English speakers who are "alphabetic readers" (412). Similar results were obtained by Mori (1998), whose data indicated different strategies employed by learners of Japanese with and without kanji (Chinese characters) background for storing artificial characters in short-term memory, and also by Koda (1989), whose data showed the advantage of beginning learners of Japanese with kanji background, over those learners without kanji background, in recognition of kana words and kanji words.

If, as these prior studies have shown, beginning learners of Japanese as FL successfully transfer their recognition strategies from L1, and "logographic readers" perform advantageously over "alphabetic readers" in Japanese word recognition tasks, then it seems reasonable to assume that the same is true in individual hiragana recognition tasks, as implied by Quackenbush et al. (1989). However, a question remains as to whether the positive transfer that the "logographic readers" experience can have an immediate and/or lasting effects on retaining the learned hiragana.

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<sup>2</sup> The reason why Quackenbush et al. (1989) did not include native speakers of English as their subjects seems to be that they believe that the effectiveness of mnemonics has been proven in instructional practice (161); however, they do not cite any empirical study that has shown such effectiveness.

This question has not yet been empirically explored and is therefore worth investigating.

Thus, the present study investigated the short- and long-term effects of mnemonic devices on retaining hiragana as FL. Two research questions were asked. One is whether the finding in Quackenbush et al.'s study (the conventional mnemonic method had a positive effect only on delayed recalls of hiragana by proficient speakers of English who had no prior experience with learning non-Roman letters as their L1 [the Roman group]) can be replicated in the present study. A positive answer to this research question means that only on the long-term recall, the Roman group benefits from the mnemonics. The other research question, which is related to the finding from strategy transfer studies (e.g., Chikamatsu, 1996), is whether learners who have prior experience in learning non-Roman scripts in their L1 (the non-Roman group) and the Roman group would perform differently on immediate and delayed recalls of hiragana. That is, the mnemonic method would not be effective for the non-Roman group, who could transfer the strategies from their previous experience in learning non-Roman scripts in L1. It is hypothesized, therefore, that: (a) neither group would benefit from the mnemonics on the immediate recall test; (b) the Roman group would perform better with the mnemonic method than with the flashcard method on the delayed recall test, while the non-Roman group would perform equally well with both methods on the same test.

In testing these hypotheses, the present study incorporated the analyses of differential effects of picture cues and sound cues by separating the two types of cues from the picture-plus-sound mnemonics. The purpose was to identify what makes picture-plus-sound mnemonics effective. Pedagogically, it is important to know the answer in order to produce and make use of effective mnemonics in future instruction. These analyses were made possible by modifying the computer freeware program developed by Hatasa et al. (1992). The modification was done by Dr. Jan Stelovski of the University of Hawaii, and the modified program was used in all of the experimental sessions. The details will be described in the method section below.

## METHOD

### 1 Participants

The participants were 66 beginning learners of Japanese at a university in Southern California: 29 were male and 37 were female, with the average age of 22.87 years. These participants were highly proficient in English and enrolled in the first quarter of an elementary Japanese course at the university, and at the time of the experiment, they had not yet been introduced to hiragana in class. Among the 66 participants, 30 had prior experience with learning non-Roman scripts as their L1; they were fluent readers of Chinese characters (21), Korean Hangul (8), and Arabic script (1) (the non-Roman group). Among the rest of the 36 participants, 8 were monolingual speakers of English, and 21 were bilinguals who spoke Spanish, Italian, Chinese, Korean, Vietnamese, Cambodian, or Thai in addition

to English; they had little or no previous knowledge of non-Roman scripts (the Roman group).<sup>3</sup>

## 2 Procedure

Each participant was scheduled to come individually to the investigator's office two times per week (either Monday and Wednesday sessions or Tuesday and Thursday sessions) to attend five 15-minute (on the average) meetings. At the first meeting, a questionnaire and a pretest were given to the participant. On the questionnaire, the participant was asked to provide his or her background information including his or her previous experience of learning non-Roman scripts. On the pretest, the participant was asked to provide, on a sheet of paper, Romanization for the hiragana that he or she knew at that time. If the result of the pretest indicated that the participant knew ten or more hiragana, his or her data were excluded from data analyses.

In the first four meetings, four computer-generated tutorial sessions of 40 hiragana were given to each participant. As mentioned above, the computer program used in this experiment was a modified version of the freeware originally created by Hatasa et al. (1992). The modification of the program was done so that there would be four versions in which each hiragana could be introduced with: (a) a picture cue and a sound cue (P + S), (b) a picture cue only (P), (c) a sound cue only (S), or (d) no cue (i.e., a flashcard) (F). The steps in which each hiragana was introduced in these four methods can be seen in Table 1. It should be mentioned that in all four of the teaching conditions, each step was viewed only once and the learner pressed the return key to move to the next step.

In each tutorial session, one of the four sets of ten hiragana was introduced using one of the four teaching methods. The four sets of ten hiragana represented: (a) /a, i, u, e, o/ and /ka, ki, ku, ke, ko/, (b) /sa, shi, su, se, so/ and /ta, chi, tsu, te, to/, (c) /na, ni, nu, ne, no/ and /ha, hi, fu, he, ho/, and (d) /ma, mi, mu, me, mo/ and /ra, ri, ru, re, ro/. The five hiragana (grouped between two slashes above) in each set were introduced in random order. The four sets of hiragana as well as the four methods of introduction were counterbalanced across participants.

Before each experimental session, a practice session was given to the participant with three hiragana, /ya, yu, yo/, using the teaching method of the day. This was done in addition to an oral explanation of the procedure illustrated on a sheet of paper, in order to make sure that the participant understood the experimental procedure (how each hiragana would be presented, reviewed, and tested) when using the computer program.

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<sup>3</sup> Four Chinese-American students and one Korean-American student in the Roman group spoke Chinese or Korean at home, but they had little knowledge of written Chinese or Korean. These students and the other 28 bilingual students were included in this group because as long as participants possessed high English proficiency, it was the presence or absence of extensive knowledge of non-Roman scripts, not the type of language spoken at home, that mattered for the research questions (i.e., whether the data from FL learners without such knowledge confirm Quackenbush et al.'s [1989] data, and whether such knowledge makes a significant difference in the use of mnemonics and the recall performances of individual hiragana).

Table 1 Steps in Which Hiragana Were Introduced Using Four Teaching Methods

	Teaching methods			
	P + S	P	S	F
Step 1 Participants heard:	 /I have a headache/	 /he/	 /I have a headache/	 /he/
Step 2 Participants heard:	 /he/ as in /headache/	 /he/	 /he/ as in /headache/	 /he/
Step 3 Participants heard:	 /he/	 /he/	 /he/	 /he/
Step 4 Participants typed:	 /he/	 /he/	 /he/	 /he/

Note: P + S = a picture and a sound cue; P = a picture cue only; S = a sound cue only; F = no cue (a flashcard).

Source: Pictures and sound cues are from Makino et al., *Nakama 1: Japanese communication, culture, context*, 1998, Houghton Mifflin Company. Used with permission.

After the practice session, the experimental session began. The experimental session, which took no more than 10 minutes, consisted of (a) a learning phase (without time limit), (b) a review phase (without time limit), and (c) a self-test phase (with time limit). In the learning phase, five of the ten hiragana in one set were randomly introduced (one at a time) in the same teaching method as the one used in the practice session (see Table 1). In the review phase, the participant reviewed the five hiragana by typing the sound of the randomly presented symbol (one at a time) until he or she typed the sounds of all five of the symbols correctly. After five more hiragana in the same set were introduced and reviewed in the same manner, the self-test phase started. In this phase, the participant had five seconds to type the sound of each of the ten hiragana, which were also randomly presented (one at a time). The experimental session ended when the participant typed the sounds of all of the ten symbols correctly. Every mouse click and key stroke made by the participant during the practice and experimental sessions were recorded by the computer program for data analyses.

The experimental session was followed by an oral interview, in which the participant was asked about the extent to which he or she utilized the provided mnemonics, and any other learning strategies he or she employed during the experimental session. When done, the participant was asked not to study hiragana elsewhere. The participant was told that there would be a recall test at the next meeting, but the result of the recall test would solely reflect the effectiveness of the tutoring session and would not affect his or her course grade. If the participant

admitted at the following meetings that he or she had reviewed or previewed hiragana, his or her data were excluded from data analyses.

At the next meeting (two to five days after the previous meeting), a recall test was given, on which the participant had to write, on a sheet of paper, the Romanscript for the ten hiragana he or she had learned in the previous meeting. When done, a different set of ten hiragana was introduced using a different teaching method. The same procedure was repeated until the fourth meeting was completed. At the fifth meeting, the participant was asked to take a recall test of the ten hiragana from the previous session, and another recall test (the posttest) of 46 hiragana, including the three hiragana, /wa, o, N/, which were not taught during the four experimental sessions. The posttest was given (on a sheet of paper) in order to make sure that the participant did not study hiragana elsewhere during the two weeks of the experiment. In other words, the participant's knowledge or lack of knowledge of /wa, o, N/ shown on the posttest had to be the same as the pretest in order for his or her data on the four recall tests to be valid. If not, his or her data were excluded from data analyses.

## RESULTS

### 1 Immediate Recall

After eliminating the data from those who knew ten or more hiragana before the experiment, and those who studied hiragana elsewhere between the experimental sessions, the rest of the data from 50 participants were analyzed.<sup>4</sup> Figure 1 shows the extent to which the mnemonic devices were utilized by the two groups of 50 participants. It should be added that: (a) when they did not use the provided mnemonics and when no mnemonics were provided (the F method), the Roman group and the non-Roman group reported to have purely memorized the symbols 88% of the time and 84% of the time, respectively; (b) the Roman group reported to have created their own mnemonics (e.g., ろ /ro/ looks like 3) 12% of the time; (c) the non-Roman group reported to have used their knowledge of their L1 scripts and other methods 12% of the time and 4% of the time, respectively.

As seen in Figure 1, a two-way Analysis of Variance (ANOVA) with the type of mnemonics as a within-subject variable showed that the participants reported to have utilized the three types of mnemonics differently,  $F(2, 94) = 12.524, p < .0001$ ; there was also a significant difference in the extent of overall use of the mnemonics between the Roman and non-Roman groups,  $F(1, 47) = 5.576, p < .05$ , although there was no significant interaction ( $p > .1$ ). Pair-wise comparisons of the types of mnemonics further indicated that overall, the participants reported to have utilized

<sup>4</sup> Among the 50 participants (23 male and 27 female, with the average age of 23.55 years), 21 had prior experience with learning non-Roman scripts as their L1; they were fluent readers of Chinese characters (15), Korean Hangul (5), and Arabic script (1) (the non-Roman group). The rest of the 29 participants were 8 monolingual speakers of English, and 21 bilinguals who spoke Spanish, Italian, Chinese, Vietnamese, Cambodian, or Thai in addition to English; they had little or no previous knowledge of non-Roman scripts (the Roman group).

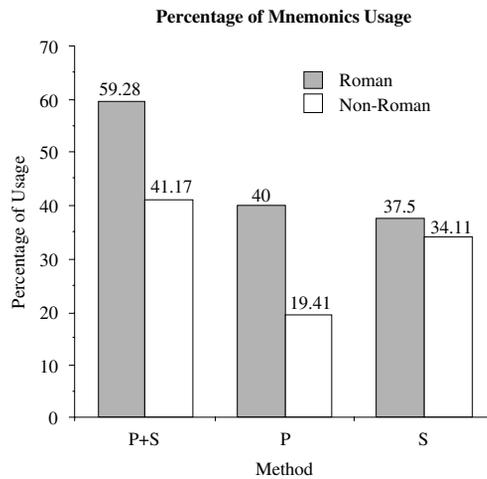


Figure 1. Usage of Three Types of Mnemonics by Roman and Non-Roman Groups in the Immediate Recall Test

the P + S method significantly more than the P method,  $F(1, 48) = 30.025$ ,  $p < .0001$ , and the S method,  $F(1, 48) = 12.575$ ,  $p < .001$ . When analyses were done separately for each group, it was found that the Roman group reported to have utilized the P + S method more than the P method and the S method ( $p < .001$  in both cases) while the non-Roman group reported to have utilized the P + S method more than the P method ( $p < .005$ ). Fisher's PLSD also indicated that the Roman group reported to have utilized the P + S method and the P method significantly more than the non-Roman group ( $p < .05$  in both cases).

Results from the self-test taken during the experiment were then analyzed to see if there were any differences among the teaching methods and between the two groups of participants. Table 2 shows the average percentage of correct recall of ten hiragana by the Roman and non-Roman groups for each of the four teaching methods. It should be mentioned that for those who had known some of the ten hiragana (but less than ten out of the total 46 hiragana, as indicated on the pretest), the percentage of correctness was calculated out of the number of hiragana they had not known.

For statistical analyses, first, the data from the P + S method were compared with those from the F method for the Roman and non-Roman groups, by employing a two-way ANOVA with the teaching method as a within-subject variable. The result showed that the main effect of the teaching method was significant,  $F(1, 48) = 6.334$ ,  $p < .05$ , and interaction between the two variables was marginally significant,  $F(1, 48) = 3.133$ ,  $p < .1$ . However, there was no significant main effect of group type ( $p = .979$ ). The interaction was marginally significant because only for the Roman group, the P + S method facilitated recall significantly better than the F method,  $F(1, 27) = 10.359$ ,  $p < .01$ .

Similar results were obtained when the data from the four teaching methods were

Table 2 Average of Correct Immediate Recall of Ten Hiragana by Roman and Non-Roman Groups by Teaching Method (%)

Group	Teaching methods			
	P + S	P	S	F
Overall				
Roman <sup>a</sup>				
Mean	55.86	43.14	50.69	41.72
Standard Deviation	22.75	19.63	22.18	23.72
Non-Roman <sup>b</sup>				
Mean	49.41	44.49	54.49	47.88
Standard Deviation	21.21	23.97	22.81	24.53
/a-ko/				
Roman <sup>a</sup>				
Mean	46.66	30.00	40.90	43.33
Standard Deviation	19.66	14.14	23.00	28.75
Non-Roman <sup>b</sup>				
Mean	44.28	31.66	50.00	57.50
Standard Deviation	23.70	27.14	27.08	28.72
/sa-to/				
Roman <sup>a</sup>				
Mean	66.66	43.63	53.33	27.03
Standard Deviation	27.14	16.29	25.82	11.89
Non-Roman <sup>b</sup>				
Mean	49.07	52.50	55.00	37.14
Standard Deviation	20.12	17.07	26.45	19.76
/na-ho/				
Roman <sup>a</sup>				
Mean	52.72	50.92	50.00	53.33
Standard Deviation	19.02	30.41	16.73	16.33
Non-Roman <sup>b</sup>				
Mean	52.50	71.11	52.85	59.25
Standard Deviation	17.07	24.14	24.97	21.98
/ma-ro/				
Roman <sup>a</sup>				
Mean	65.00	47.59	66.66	42.52
Standard Deviation	28.10	14.11	15.05	27.30
Non-Roman <sup>b</sup>				
Mean	55.83	35.71	59.07	40.00
Standard Deviation	27.93	9.75	20.67	29.43

Notes: P + S = a picture and a sound cue; P = a picture cue only; S = a sound cue only; F = no cue (a flashcard). /a-ko/ = /a, i, u, e, o, ka, ki, ku, ke, ko/; /sa-to/ = /sa, shi, su, se, so, ta, chi, tsu, te, to/; /na-ho/ = /na, ni, nu, ne, no, ha, hi, fu, he, ho/; /ma-ro/ = /ma, mi, mu, me, mo, ra, ri, ru, re, ro/.

<sup>a</sup> n = 29, <sup>b</sup> n = 21.

compared for the Roman and non-Roman groups; only the main effect of teaching method was statistically significant,  $F(3, 144) = 3.704$ ,  $p < .05$ . The results of the ANOVA for simple effects further indicated that overall, both the P + S method and the S method facilitated immediate recall of hiragana more than the P method,  $F(1, 48) = 7.448$ ,  $p < .01$ , and  $F(1, 48) = 5.104$ ,  $p < .05$ , respectively, and the F method,  $F(1, 48) = 6.300$ ,  $p < .05$ , and  $F(1, 48) = 5.043$ ,  $p < .05$ , respectively.

When separate analyses were done for each group, a one-way ANOVA for repeated measures indicated that the four methods differed significantly in affecting recall performances for the Roman group,  $F(3, 84) = 4.406$ ,  $p < .01$ , but not for the non-Roman group ( $p = .4644$ ). The ANOVA for simple effects further showed that the Roman group performed significantly better with the P + S method than with the P method,  $F(1, 28) = 10.398$ ,  $p < .01$ , and the F method,  $F(1, 28) = 9.534$ ,  $p < .01$ ; the S method worked marginally better than the F method,  $F(1, 28) = 4.021$ ,  $p < .1$ .

Interestingly, as seen in Table 2, when separate analyses were done for each set of ten hiragana, a two-way ANOVA showed that there was a main effect of teaching method for two sets of hiragana, /sa, shi, su, se, so, ta, chi, tsu, te, to/,  $F(3, 42) = 3.332$ ,  $p < .05$ , and /ma, mi, mu, me, mo, ra, ri, ru, re, ro/,  $F(3, 42) = 3.161$ ,  $p < .05$ . There was neither group effect ( $p = .7424$  for the former set;  $p = .2476$  for the latter set) nor interaction ( $p = .5109$  for the former set;  $p = .9638$  for the latter set). Fisher's PLSD further indicated that for the former set of ten hiragana, the P + S method and the S method worked significantly better than the F method ( $p < .01$  and  $p < .05$ , respectively). For the latter set of ten hiragana, both the P + S method and the S method worked better than the P method ( $p < .05$ ) and the F method ( $p < .05$ ). When separate analyses were done for each group, however, significant differences were found among the teaching methods only for the Roman group and only on the former set of ten symbols,  $F(3, 25) = 3.223$ ,  $p < .05$ . Fisher's PLSD further indicated that on this set of hiragana, the Roman group performed better with the P + S method and the S method than with the F method ( $p < .01$  and  $p < .05$ , respectively). For a close examination of the items on which the P + S method was effective, the percentages of participants who correctly recalled individual hiragana in the set of /sa, shi, su, se, so, ta, chi, tsu, te, to/ on the immediate recall test are presented in Table 3.<sup>5</sup> The data will be discussed in the discussion section of this paper.

<sup>5</sup> Table 3 lists the data on these ten symbols only, because of their relevance to the discussion. The methodological differences were found to be statistically significant only for this set of hiragana when the analyses were done for each group.

<sup>6</sup> Among the 45 participants (22 male and 23 female, with the average age of 23.43 years), 17 had learned non-Roman scripts as their L1; they were fluent readers of Chinese characters (11), Korean Hangul (5), and Arabic script (1) (the non-Roman group). The rest of the 28 participants were eight monolingual speakers of English, and 20 bilinguals who spoke Spanish, Italian, Chinese, Vietnamese, Cambodian, or Thai in addition to English; they had little or no previous knowledge of non-Roman scripts (the Roman group).

Table 3 Participants Who Correctly Recalled /sa, shi, su, se, so, ta, chi, tsu, te, to/ on the Immediate Recall Test (%)

Picture Sound cue Sound		Teaching methods			
		P + S	P	S	F
	Overall	33.33	46.66	20.00	23.07
	/sake/ Roman	33.33	45.45	0.00	16.66
	/sa/ Non-Roman	33.33	50.00	50.00	28.57
	Overall	25.00	26.66	60.00	38.46
	/she/ Roman	33.33	27.27	40.00	33.33
	/shi/ Non-Roman	16.66	25.00	75.00	42.85
	Overall	45.45	26.66	50.00	38.46
	/swimming/ Roman	50.00	27.27	33.33	33.33
	/su/ Non-Roman	40.00	25.00	25.00	57.14
	Overall	75.00	20.00	40.00	30.76
	/señor/ Roman	66.66	0.00	50.00	0.00
	/se/ Non-Roman	83.33	75.00	25.00	57.14
	Overall	33.33	46.66	40.00	30.76
	/ (zigzag) so much/ Roman	33.33	45.45	50.00	16.66
	/so/ Non-Roman	33.33	50.00	25.00	42.85
<i>ta</i>	Overall	100.00	80.00	70.00	69.23
	/t and a/ Roman	100.00	72.72	66.66	40.00
	/ta/ Non-Roman	100.00	100.00	75.00	85.71
	Overall	41.66	33.33	40.00	23.07
	/cheerleader/ Roman	50.00	27.27	33.33	33.33
	/chi/ Non-Roman	33.33	50.00	50.00	14.28
	Overall	41.66	20.00	50.00	23.07
	/cat's tail/ Roman	83.33	27.27	50.00	33.33
	/tsu/ Non-Roman	0.00	0.00	50.00	14.28
	Overall	66.66	66.66	70.00	23.07
	/table/ Roman	66.66	63.63	83.33	16.66
	/te/ Non-Roman	66.66	75.00	50.00	28.57

	Overall	91.16	93.33	90.00	15.38
/toe/	Roman	100.00	100.00	100.00	16.66
/to/	Non-Roman	83.33	75.00	75.00	14.28

Notes: P + S = a picture and a sound cue; P = a picture cue only; S = a sound cue only; F = no cue (a flashcard). Overall data indicate the percentage of the participants in both groups ( $n = 50$ ) who recalled the sounds of the symbols correctly. Roman data indicate the percentage of the participants in the Roman group ( $n = 29$ ) who recalled the sounds of the symbols correctly. Non-Roman data indicate the percentage of the participants in the non-Roman group ( $n = 21$ ) who recalled the sounds of the symbols correctly.

Source: Pictures and sound cues are from Makino et al., *Nakama 1: Japanese communication, culture, context*, 1998, Houghton Mifflin Company. Used with permission.

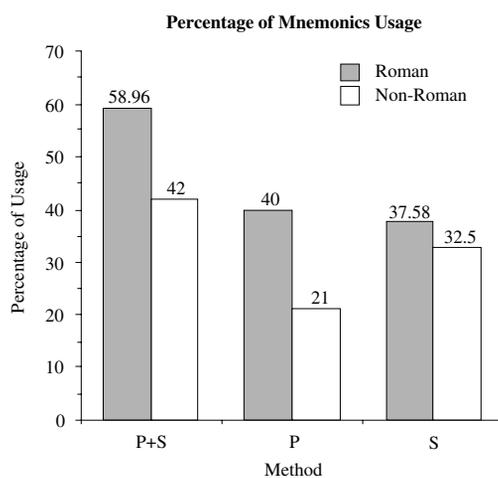


Figure 2. Usage of Three Types of Mnemonics by Roman and Non-Roman Groups in Delayed Recall Test

## 2 Delayed Recall

After further eliminating the data from those who studied hiragana between the fourth and fifth meetings, the rest of the data from 45 participants were analyzed.<sup>6</sup> Figure 2 shows the extent to which the mnemonic devices were utilized by the two groups of 45 participants. It should be added that: (a) when they did not use the provided mnemonics and when no mnemonics were provided (the F method), the Roman group and the non-Roman group reported to have purely memorized the symbols 90% of the time and 85% of the time, respectively; (b) the Roman group reported to have created their own mnemonics (e.g., ん /ro/ looks like 3) 10% of the time; (c) the non-Roman group reported to have used their knowledge of their L1 scripts and other methods 10% of the time and 5% of the time, respectively.

As seen in Figure 2, a two-way ANOVA with the type of mnemonics as a within-subject variable showed that the participants reported to have utilized the three

Table 4 Average of Correct Delayed Recall of Ten Hiragana by Roman and Non-Roman Groups by Teaching Method (%)

Group	Teaching methods			
	P + S	P	S	F
Overall				
Roman <sup>a</sup>				
Mean	29.19	20.35	29.55	21.80
Standard Deviation	25.34	17.26	21.64	19.06
Non-Roman <sup>b</sup>				
Mean	28.85	26.92	30.05	29.47
Standard Deviation	18.61	27.88	26.17	33.59
/a-ko/				
Roman <sup>a</sup>				
Mean	32.91	8.33	19.00	23.88
Standard Deviation	36.62	7.52	17.28	15.40
Non-Roman <sup>b</sup>				
Mean	18.00	29.53	45.00	50.00
Standard Deviation	19.23	23.99	38.73	40.00
/sa-to/				
Roman <sup>a</sup>				
Mean	33.33	19.00	36.25	10.83
Standard Deviation	26.58	17.28	13.57	12.00
Non-Roman <sup>b</sup>				
Mean	42.66	37.50	23.33	8.00
Standard Deviation	18.76	30.95	20.81	13.03
/na-ho/				
Roman <sup>a</sup>				
Mean	26.00	29.44	38.33	33.33
Standard Deviation	23.66	22.54	30.60	25.03
Non-Roman <sup>b</sup>				
Mean	22.50	43.33	22.00	34.20
Standard Deviation	15.00	41.63	22.80	30.30
/ma-ro/				
Roman <sup>a</sup>				
Mean	26.66	25.50	33.33	20.00
Standard Deviation	18.61	14.05	19.66	18.85
Non-Roman <sup>b</sup>				
Mean	32.50	6.00	30.20	35.00
Standard Deviation	10.89	8.94	23.24	47.25

Notes: P + S = a picture and a sound cue; P = a picture cue only; S = a sound cue only; F = no cue (a flashcard). /a-ko/ = /a, i, u, e, o, ka, ki, ku, ke, ko/; /sa-to/ = /sa, shi, su, se, so, ta, chi, tsu, te, to/; /na-ho/ = /na, ni, nu, ne, no, ha, hi, fu, he, ho/; /ma-ro/ = /ma, mi, mu, me, mo, ra, ri, ru, re, ro/.

<sup>a</sup> n = 28, <sup>b</sup> n = 17.

types of mnemonics differently,  $F(2, 86) = 11.425$ ,  $p < .0001$ ; there was also a significant difference in the extent of overall use of the mnemonics between the Roman and non-Roman groups,  $F(1, 43) = 5.071$ ,  $p < .05$ , although there was no significant interaction ( $p > .1$ ). Pair-wise comparisons of the types of mnemonics further indicated that overall, the participants reported to have utilized the P + S method significantly more than the P method,  $F(1, 44) = 27.082$ ,  $p < .0001$ , and the S method,  $F(1, 44) = 10.842$ ,  $p < .01$ . This pattern of results was also found when analyses were done separately for the Roman group ( $p < .001$ ) and for the non-Roman group ( $p < .05$ ). Fisher's PLSD further indicated that the Roman group reported to have utilized the P + S method and the P method significantly more than the non-Roman group ( $p < .05$  in both cases).

Data from the delayed recall tests were then analyzed to see if there were any differences among the teaching methods and between the two groups of participants. Table 4 shows the average percentage of correct recall of ten hiragana by the Roman and non-Roman groups for each of the four teaching methods. For those who had known some of the ten hiragana (as indicated on the pretest), the percentage of correctness was calculated out of the number of hiragana they had not known.

For statistical analyses, the data from the P + S method (the conventional method) were first compared with those from the F method for the Roman and non-Roman groups, by employing a two-way ANOVA with the teaching method as a within-subject variable. The result showed that there was no main effect of teaching method ( $p = .3634$ ) or group type ( $p = .5195$ ). There was no interaction between the two variables ( $p = .4184$ ). The result was the same when the data from the four teaching methods were compared for the Roman and non-Roman groups; there were no main effects and no interaction ( $p > .2$  in all cases). Moreover, when separate analyses were done for each group, a one-way ANOVA for repeated measures showed no significant differences between the P + S method and the F method or among the four methods for either group ( $p > .1$  in all cases).

Interestingly, as seen in Table 4, when separate analyses were done for each set of ten hiragana, a two-way ANOVA showed that there was a main effect of teaching method for one set of hiragana, /sa, shi, su, se, so, ta, chi, tsu, te, to/,  $F(3, 37) = 4.271$ ,  $p < .05$ , though there was neither group effect ( $p = .6207$ ) nor interaction ( $p = .3092$ ). Fisher's PLSD further indicated that for this set of hiragana, the P + S method and the S method worked significantly better than the F method ( $p < .01$  and  $p < .05$ , respectively). When separate analyses were done for each group, however, the same pattern was only marginally significant ( $p < .1$ ) for the Roman group. For a close examination of the items on which the P + S method was effective, the percentages of participants who correctly recalled individual hiragana in the set of /sa, shi, su, se, so, ta, chi, tsu, te, to/ on the delayed recall test are presented in Table 5. The data will be discussed in the next section of this paper.

Table 5 Participants Who Correctly Recalled /sa, shi, su, se, so, ta, chi, tsu, te, to/ on Delayed Recall Test (%)

Picture Sound cue Sound		Teaching methods			
		P + S	P	S	F
	Overall	25.00	7.14	0.00	0.00
	Roman	28.57	0.00	0.00	0.00
	Non-Roman	20.00	25.00	0.00	0.00
	Overall	58.33	42.85	55.55	40.00
	Roman	57.14	30.00	50.00	60.00
	Non-Roman	60.00	75.00	66.66	20.00
	Overall	25.00	14.28	33.33	10.00
	Roman	28.57	10.00	16.66	0.00
	Non-Roman	20.00	25.00	66.66	20.00
	Overall	50.00	14.28	44.44	10.00
	Roman	42.85	0.00	50.00	0.00
	Non-Roman	60.00	50.00	33.33	20.00
	Overall	41.66	21.42	22.22	10.00
	Roman	28.57	20.00	16.66	20.00
	Non-Roman	60.00	25.00	33.33	0.00
ta 	Overall	41.66	28.57	22.22	20.00
	Roman	42.85	20.00	16.66	20.00
	Non-Roman	40.00	50.00	33.33	20.00
	Overall	0.00	0.00	11.11	0.00
	Roman	0.00	0.00	16.66	0.00
	Non-Roman	0.00	0.00	0.00	0.00
	Overall	16.66	14.28	22.22	0.00
	Roman	14.28	20.00	33.33	0.00
	Non-Roman	20.00	0.00	0.00	0.00
	Overall	25.00	35.71	33.33	0.00
	Roman	14.28	30.00	50.00	0.00
	Non-Roman	40.00	50.00	0.00	0.00

	Overall	58.33	71.42	66.66	10.00
/toe/	Roman	42.85	70.00	100.00	20.00
/to/	Non-Roman	80.00	75.00	0.00	0.00

Notes: P + S = a picture and a sound cue; P = a picture cue only; S = a sound cue only; F = no cue (a flashcard). Overall data indicate the percentage of the participants in both groups ( $n = 45$ ) who recalled the sounds of the symbols correctly. Roman data indicate the percentage of the participants in the Roman group ( $n = 28$ ) who recalled the sounds of the symbols correctly. Non-Roman data indicate the percentage of the participants in the non-Roman group ( $n = 17$ ) who recalled the sounds of the symbols correctly.

Source: Pictures and sound cues are from Makino et al., *Nakama 1: Japanese communication, culture, context*, 1998, Houghton Mifflin Company. Used with permission.

## DISCUSSION

In the present study, two hypotheses were tested to confirm the results from the Quackenbush et al. study (1989) and to test the benefit of L1 script recognition strategy transfer (e.g., Chikamatsu, 1996). The first hypothesis was that neither the Roman group nor the non-Roman group would benefit from the commonly used mnemonics (the P + S method) on the immediate recall test. The second hypothesis was that the Roman group would perform better with the P + S method than with the flashcard method (the F method) on the delayed recall test, while the non-Roman group would perform equally well with both methods on the same test.

### 1 Hypothesis 1 (Immediate Recall)

The results of the immediate recall test showed that the first hypothesis was only half supported. Overall, the P + S method was found to be more effective than the F method for the Roman group (not supporting the hypothesis), but not for the non-Roman group (supporting the hypothesis). In fact, further analyses of the overall performance data (Table 2) indicated that the non-Roman group did equally well with all of the four methods, while the Roman group did significantly better with the P + S method than with the P method and the F method. A similar pattern was also evident on a particular set of hiragana, /sa, shi, su, se, so, ta, chi, tsu, te, to/; the Roman group performed better with the P + S method and the S method than with the F method, whereas the non-Roman group performed equally well with all of the four methods (Table 2). Interestingly, these results were obtained when overall both groups performed equally well (i.e., no main effect of group type in Table 2) despite the fact that the Roman group reported to have utilized the provided mnemonics significantly more than the non-Roman group (i.e., significant main effect of group type in Figure 1).

What these results seem to suggest is that the non-Roman group did something (besides using the provided mnemonics) to perform as well as the Roman group. In other words, it seems possible to assume that while the Roman group relied on and benefited from the conventional mnemonics for the short-term recall, particularly

on /sa, shi, su, se, so, ta, chi, tsu, te, to/, the non-Roman group did not, or perhaps did not have to rely on them so much to perform equally well as the Roman group. Whether this is due to L1 strategy transfer, however, could not be said based on the present study. What could be said is that the unique strategies (which could include L1 strategy transfer) employed by the non-Roman group were as helpful as the P + S mnemonics utilized by the Roman group. In order to further investigate this point, future studies should employ a research methodology, such as talk-aloud protocols (Trabasso and Suh, 1993, cited in Horiba, 1996), that allows an examination of subjects' cognitive strategies while learning is taking place at the introduction stage and also while remembering is taking place at the test stage.

The immediate recall data obtained from the 29 participants in the Roman group in the present study, who had known less than ten hiragana prior to the experiment, did not confirm the results obtained by the 16 participants in the Quackenbush et al. study (1989), who had known at least one-half of 46 hiragana prior to the experiment. Only in the present study did the Roman group gain significantly from the conventional mnemonics for the short-term recall. One reason for the difference in results could be that, as mentioned earlier, in Quackenbush et al.'s study, the horizontal and vertical lines on the flashcards might have encouraged the participants in the flashcard group to rely on that organization. In contrast, in the present study, all of the 40 hiragana were introduced, reviewed, and tested in a random order on purpose, necessarily preventing the participants from using the order information during the experiment. This carefully controlled research methodology might have made the recall task more difficult than that of the Quackenbush et al. study, especially with the F method. Furthermore, the five-minute time limit on the recall test in the present study might have made the task even more difficult; in the Quackenbush et al. study, there was no such time limit.

A reversed explanation might also be possible for the difference in results. That is, the task of providing Romanization for 46 hiragana in the Quackenbush et al. study might have been more difficult than the task of providing Romanization for ten hiragana at a time in the present study. In other words, the task used by Quackenbush et al. might have been equally too difficult for the mnemonic group and the flashcard group, and as a result, no difference was found in their immediate recall. Future studies should be conducted in order to determine which explanation is correct.

## **2 Hypothesis 2 (Delayed Recall)**

As for the second hypothesis regarding the long-term recall, it also appears to be half supported by the results of the present study. Overall, neither the Roman group (not supporting the hypothesis) nor the non-Roman group (supporting the hypothesis) seems to have benefited from the P + S method or any other mnemonic methods; none of the mnemonic methods was found to facilitate delayed recall of hiragana better than the F method, except for one set of hiragana, /sa, shi, su, se, so, ta, chi, tsu, te, to/ (Table 4). These results were obtained despite the significant differences among the teaching methods and between the groups found on the

participants' self-report of the usage of the mnemonics during the experiment (Figure 2). In other words, both groups of participants used the three types of mnemonics to different extents when learning the symbols (the P + S method more than the other methods), but on the delayed recall tests, they largely remembered those symbols to an equal extent, and to the same extent as those which they learned with the F method (without mnemonics).

Interpretation of these results in relation to the issue of L1 strategy transfer requires caution. It is true that the non-Roman group's overall performances were comparable to those of the Roman group on both immediate and delayed recall tests. However, it should be noticed that while their overall performances on the immediate recall test were as good as those of the Roman group when they used the P + S mnemonics, their overall performances on the delayed recall test were as poor as those of the Roman group when they used the F method (among other methods). Thus, even if the non-Roman group transferred their script recognition strategies from L1 when learning hiragana, the lasting effects of those strategies seem questionable. What seems to have happened over time is that the unique strategies (which could include L1 strategy transfer) employed by the non-Roman group lost their power, just like the power of the P + S mnemonics utilized by the Roman group more or less faded away by the time of the delayed recall test. Future studies are certainly necessary to investigate this point further.

The results of the delayed recall by the Roman group (28 participants) in the present study again differ from those obtained from the 16 participants in the Quackenbush et al. (1989) study. One reason for this difference in result could have something to do with the task demand. As mentioned earlier, in the Quackenbush et al. study, the delayed recall test was a recognition test on which the participants were required only to match the sound they heard with one of the five hiragana. In the present study, however, the participants were required to recall the sounds and write them in Roman letters for all of the ten hiragana they had learned in the previous session. This difference in task demand (the recognition task being easier than the recall task) might have played a role in producing the different results.

Another reason for the difference in results could have something to do with practice. Whereas the participants in the present study were purposefully and necessarily discouraged from studying hiragana between the experimental sessions, those in the Quackenbush et al. study were encouraged to review hiragana during the three days between the time when hiragana were introduced and the time when the delayed recognition test was given. The extra practice done by the participants in the Quackenbush et al. study might have made the association between the mnemonic cues and the hiragana symbols stronger. It is not clear, however, whether their mnemonic group practiced more than their flashcard group, or how these two groups practiced outside the classroom. Given the present study's finding that the P + S method was effective for the short-term recall for the Roman group (particularly for /sa, shi, su, se, so, ta, chi, tsu, te, to/), and that the effectiveness disappeared (except for /sa, shi, su, se, so, ta, chi, tsu, te, to/) without practice, it seems possible to assume that the extra practice done by the participants in the Quackenbush et al.

study significantly contributed to their findings. Future research is necessary to clarify the relationship between effective practice and mnemonic instruction.

### 3 What Makes the P + S Mnemonics Effective?

As mentioned earlier, the purpose of separating the two types of cues (i.e., the sound [S] and the picture [P]) from the picture-plus-sound mnemonics (the P + S method) in data analyses was to identify what makes the P + S mnemonics effective. In an attempt to fulfill the purpose, the percentages of participants in the Roman group who correctly recalled /sa, shi, su, se, so, ta, chi, tsu, te, to/ on the two tests (Tables 3 and 5) are closely examined.<sup>7</sup>

In Table 3, the P + S method seems to have been effective for the Roman group's immediate recall on /sa, su, se, so, ta, chi, tsu, te, to/. Among these, /sa/ is the case in which the P method also worked, /se, tsu/ are the cases in which the S method also worked, /ta, te, to/ are the cases in which both the P method and the S method worked well, and /su, chi/ are the cases in which neither the P method nor the S method worked as well as the P + S method. It is interesting to observe that for the Roman group, the picture of "a person drinking sake" triggered /sa/ successfully while the sound of /sake/ did not. Apparently associating the sound of /sake/ with the shape of the hiragana was a difficult task without the picture. It is also interesting to notice that the sounds of /señor/ and /cat's tail/ were more effective than their pictures. These appear to be the cases in which the English explanations of the pictures were necessary; the pictures of "a gentleman" would not trigger /se/, and the picture of "a cat showing the tail" would not trigger /tsu/ easily. In the cases of /ta, te, to/, it seems that the pictures were self-explanatory to come up with the intended words in the P method, and that the words successfully triggered the images close to the pictures in the S method. In the case of /chi/, both types of cues appear to have been needed; one cue alone was not strong enough to facilitate recall. In the case of /so/, all three mnemonic methods worked slightly better than the F method, though one would not expect that the picture alone is strong enough. The only case in which the P + S method did not work better than the F method is /shi/. Oddly, the data on /shi/ indicated that the S method worked best among the four methods. Again, future research using a methodology such as talk-aloud protocols (Trabasso and Suh, 1993, cited in Horiba, 1996) is needed to explain these types of phenomena.

As for the data from the Roman group's delayed recall test (Table 5), they showed a similar pattern to those from the immediate recall test (Table 3); compared to the F method, the P + S method worked better on /sa, su, se, so, ta, tsu, te, to/. In five of these cases, however, the S method and/or the P method appear to have been

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<sup>7</sup> To repeat, the Roman group's data on /sa, shi, su, se, so, ta, chi, tsu, te, to/ were considered relevant for the discussion because their performance data (Tables 2 and 4) showed that when separate analyses were done for four sets of hiragana, the effects of mnemonics were statistically significant only for this set, strongly so ( $p < .05$ ) on the immediate recall test, and weakly so ( $p < .1$ ) on the delayed recall test.

more facilitative than the P + S method. Although the importance of the sound cues, such as /señor/ and /cat's tail/, is still observable in the good results with the S method, and in the case of /sa/, one cue alone (P or S) was not effective, this result alone seems to show a sign of their delayed recall performances being no longer directly affected by the provided mnemonics. There is no wonder that even for the Roman group, the long-term effects of mnemonics were only marginally significant on this set of symbols, and that no significant differences were found among the teaching methods on the other three sets of hiragana (Table 4).

Although it is only a preliminary observation on the limited set of data, the above examination of the items on which the P + S method worked well seems to suggest that for the conventional mnemonics to be truly effective at least for the short term, the picture and sound cues need to be unambiguously associated (e.g., /ta, to/ in Table 3)—the picture unambiguously triggering the intended words, and the words unambiguously describing the picture. Of course, more research is necessary to confirm or disconfirm the given observation about what makes the mnemonics effective for the short term. In addition, to find out what makes them effective for the long term should be an important research endeavor.

## CONCLUSION

This paper first reported the research findings that the conventional mnemonics were initially effective only for those learners of Japanese without prior experience in learning non-Roman scripts, and that the effectiveness largely faded away without practice. Second, it discussed why these results differed from those reported in the Quackenbush et al. (1989) study, what their implications are in terms of L1 script recognition strategy transfer (e.g., Chikamatsu 1996), and what makes conventional mnemonics effective. By so doing, it pointed out the importance of practice for long-term retention of learned hiragana, the uncertainty of the long-term effect of L1 strategy transfer, and the importance of unambiguous association between the sound and the picture for mnemonics to be effective at least for short-term retention. As mentioned above, further studies are necessary to confirm or disconfirm these points, and thereby to better understand the acquisition processes of hiragana and contribute to the enhancement of their instruction.

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## Appendix

### Hiragana Chart

ん	わ	ら	や	ま	は	な	た	さ	か	あ
N	wa	ra	ya	ma	ha	na	ta	sa	ka	a
		り		み	ひ	に	ち	し	き	い
		ri		mi	hi	ni	chi	shi	ki	i
		る	ゆ	む	ふ	ぬ	つ	す	く	う
		ru	yu	mu	fu	nu	tsu	su	ku	u
		れ		め	へ	ね	て	せ	け	え
		re		me	he	ne	te	se	ke	e
	を	ろ	よ	も	ほ	の	と	そ	こ	お
	o	ro	yo	mo	ho	no	to	so	ko	o

Note: The 46 hiragana are traditionally read vertically from the upper right corner in the order of /a/, /i/, /u/, /e/, /o/, /ka/, /ki/, /ku/, /ke/, /ko/, and so on.