

The Effect of Exposure to Rhyming Words on the L2 Word Learning

Li-Ning Guo Chieh-Fang Hu

Taipei Municipal University of Education

Abstract

Two experimental word-learning tasks were used to investigate the effect of exposure to rhyming words on L2 word learning among 120 fourth-grade Chinese-speaking children. The children were divided into four groups. Two groups were randomly assigned to a pre-exposure word-learning task and the other two a direct word-learning task. In the pre-exposure word-learning task, one group of children were told a story containing words which rhymed with the target words to be learned whereas the other group heard a story containing words that did not rhyme with the target words. In the direct word-learning task, one group directly learned three rhyming words without pre-exposure to rhyming words in a story and some directly learned three non-rhyming words. The results revealed that pre-exposure to rhyming words embedded in a story did not affect children's new word learning. However, learning rhyming words together facilitated free recall and word-referent association in a production task. These results suggest that phonological manipulation in the rime unit of the new words provides a cue to the phonological shape of the new words, which facilitates the construction of phonological representations as well as the mapping of the representations to referents.

Key Words: rhyming words, phonological priming, phonological similarity, vocabulary learning, second language acquisition

INTRODUCTION

The ability to learn new words plays a crucial role in second and foreign language learning (Lewis, 1993; Nattinger & DeCarrico, 1992). When learning a new word, a learner has to encode the phonological representation of the word, identify the appropriate referent or meaning of the word and generalize that word to other appropriate referents (Demke, Graham, & Siakaluk, 2002). Much of the literature examining L2 vocabulary learning focuses on how to help language learners remember the meanings of a new word such as using drama, semantic mapping, key words, morphological knowledge, and context (Anderson-Inman, Knox-Quinn, & Horney, 1996; Foil & Alber, 2002; Moore & Surber, 1992; Ranger, 1995; Shostak, 2002; Slattery & Willis, 2001). Few studies have focused on the phonological component of vocabulary acquisition, the very initial step of vocabulary learning in most cases. A concept cannot be lexicalized unless the word form which carries the meaning is “remembered” or “recognized” in the first place. The present study explored the potential ways in instruction which involves the manipulation of the phonological aspect of words to be learned and examined the effects of the instruction on L2 word learning.

LITERATURE REVIEW

Rhyming and the Phonological Priming Effect

Teaching vocabulary by manipulating the phonological components of new words is not commonly seen in an L2 classroom. The most popular but contentious method perhaps is the keyword method, such as associating *geography* with *ji-fei-gou-tiao* “chicken-fly-dog-jump,” a phonologically similar idiomatic expression in Chinese. The memory of the mapping between the meaning and the pronunciation of the word *geography* can be enhanced by conjuring a mental image with chickens and dogs jumping and flying on a map. While the keyword method can be effective in facilitating memory of certain words, it is often difficult to find a suitable mediating word which relates to the target word both in form and meaning.

Another way to facilitate the phonological aspect of L2 word learning is to manipulate the phonological components of the target words and ignore the semantic relation between the words. L1 research has demonstrated that presenting a set of similar-sounding words (e.g., *snake*, *make*, *lake*) prior to the introduction of a target word (e.g., *hake*) facilitates the learning process of the target word (Bowles & Poon, 1985; Collins & Ellis, 1992; Lupker & Williams, 1989; McEvoy, 1988; Merriman & Marazita, 1995; Slowiaczek, Nusbaum, & Pisoni, 1987; Wilshire & Saffran, 2005).

This facilitative effect is usually termed as a phonological priming effect. In a study examining the effect of pre-exposure to similar-sounding words on two-year-olds' word learning, Merriman and Marazita (1995) found that pre-exposure to similar-sounding words helped the children map the novel word onto an unfamiliar picture instead of a familiar one more easily. It is believed that the shared phonological features (i.e., /ek/) between the prime word (e.g., *snake*, *make*, *lake*) and the target word (i.e., *hake*) make the target word more accessible and at the same time make the non-shared component (i.e., *sn-*, *m-*, and *l-* in *snake*, *make*, and *lake* vs. *h-* in *hake*) more distinct, leading to enhanced word learning. However, not all studies found that pre-exposure to rhyming words facilitated new word learning (Demke et al., 2002). For example, in Demke et al.'s (2002) study, they used rhyming primes and embedded them in a story as the exposure. Four-year-old children were told a story containing words that either rhymed with the target word or did not rhyme with the target word. Immediately after being read the story, the child was taught a new label for a new object. It was found that pre-exposure to the rhyming words did not facilitate the naming of the object. The mixed findings may result from the differences in task demands between studies. In Merriman and Marazita (1995), children picked up the picture named by the test giver. In Demke et al. (2002), children were required to name the object. It is possible that the phonological priming effect is sustainable to the extent where no verbal production is required.

Rhyming and the Phonological Similarity Effect

One may argue that presenting a set of similar-sounding words may impede rather than facilitate new word learning, due to the phonological similarity effect that is often observed in memory tasks. A phonological similarity effect is a confusion effect, in which phonologically similar words (e.g., *cat*, *mat*, and *rat*) are found to be harder to recall than those that are phonologically distinct (e.g., *man*, *egg*, and *boat*) (Conrad, 1964; Conrad & Hull, 1964; Gathercole & Baddeley, 1993). More recently, however, L1 research has indicated that the information that is disrupted by phonological similarity is the *order* information (i.e., the sequential order in which the items are presented) rather than the *item* information (i.e., the phonological, lexical, and semantic content of the verbal items presented) in the memory task (Fallon, Groves, & Tehan, 1999; Gupta, Lipinski, & Aktunc, 2005; Nairne & Kelley, 1999; Nimmo & Roodenrys, 2004, 2005; Poirier & Saint-Aubin, 1996; Watkins, Watkins, & Crowder, 1974; Wickelgren, 1965). When only item information is taken into account irrespective of the correctness of the serial order of the items in the sequence, phonological similarity among the items to be recalled sometimes results in an opposite effect, i.e., a facilitative effect where more items are recalled correctly. For

example, some researchers have found that though item recall is impeded when the items in the list share the CV_ body such as *mace*, *maim*, and *mate*, which share the initial consonant and the vowel, or the C_C component such as *bide*, *beard*, and *bird*, which share the initial and the final consonants, item recall is actually facilitated when the items rhyme such as *came*, *name*, and *maim* (Gupta et al., 2005; Fallon et al., 1999; Nimmo & Roodenrys, 2004). According to Hartley and Houghton (1996), the shared rime unit is the sonority peak of a syllable and thus provides a strong phonological cue to the phonological shape of the new words in the list, leading to a better recall of rhyming items than non-rhyming items.

Most of the studies investigating the phonological similarity effect were conducted by using tasks of short-term memory, such as serial recall and recognition. Nevertheless, we expect that the findings from those studies have some implications for L2 word learning as literature supports a connection between phonological short-term memory and word learning (Baddeley, Gathercole, & Papagno, 1998; Baddeley, Papagno, & Vallar, 1988; Gathercole, Hitch, Service, & Martin, 1997; Michas & Henry, 1994; Papagno, Valentine, & Baddeley, 1991). Based on the findings, it is suggested that learning a list of words that are phonologically similar at the rime unit may facilitate L2 word learning, as the memory load for encoding and constructing multiple, parallel phonological units of a word can be substantially reduced by recurrence of the rimes in the input.

The Current Study

The current study presents an initial attempt to find a potential way to facilitate L2 word learning by drawing on two lines of research, phonological priming and phonological similarity. Two experimental word-learning tasks were conducted to examine the interaction between the phonological priming effect and the phonological similarity effect on L2 word learning respectively. In the first task, we aimed to replicate the studies conducted by Merriman and Marazita (1995) and Demke et al (2002) to see whether pre-exposure to rhyming words embedded in a story influences children's new word learning. With the task, we were able to see whether new word learning would be affected by phonological priming in our L2 context. In the second task, the children learned a list of new words that rhymed with each other or a list of new words that did not rhyme. The children learned the words directly without being pre-exposed to the rhyming words. With the task, we were able to see whether learning a list of rhyming words would be affected by phonological similarity. As the children were not pre-exposed to other rhyming words, any facilitation or inhibition effect could not be attributed to the phonological priming effect.

METHOD

Participants

The study recruited 120 fourth-grade Chinese-speaking children aged nine to ten. The participants were put into four groups, 30 per group. The grouping procedure began with randomly assigning the participants to one of two word-learning tasks: Pre-Exposure or Direct. The participants assigned to each word learning task were then randomly assigned to one of two rhyming conditions: Matched or Mismatched. Thus, four orthogonal groups were formed. These four groups did not differ in phonological short-term memory as measured by a Chinese nonword repetition test ($F(3, 116) = 0.19, p > .05$) or English vocabulary as indexed by their performances in an English vocabulary test ($F(3, 116) = 0.03, p > .05$). After grouping, the participants were given a questionnaire to obtain information about their English learning background and to make sure that the four groups did not differ in any significant way in terms of English learning background. See the following section for the details of the grouping tests.

Participant Grouping Tests

Questionnaire of background information. The questionnaire, designed by the first author, was used to gather information about the participants' English learning background. Questions included when the children started to learn English, how long they had been learning English, and whether they had attended to a cram school. See Appendix A for the items in the questionnaire. The questionnaires were taken home by the children and were completed by their parents. Children of the four groups were matched as closely as possible for their background information of learning English.

Chinese nonword repetition test. The test, developed by Hu and Schuele (2005), measured children's phonological short-term memory capacity. There were six trials. The child listened to three Chinese disyllabic nonsense words in each trial read by the test giver. The test giver read the stimuli in each trial as if there were three disyllabic words, with pause in between the words. Right after the test giver read the nonsense words, the child had to repeat them as they were presented. The score was the sum of the number of the syllables the child repeated correctly across the trials (Max = 6 trials \times 6 syllables = 36).

English vocabulary test. The test, adopted from Hu and Schuele (2005) which reported a satisfactory reliability of .90, measured children's current English vocabulary. It consisted of two practice trials and a series of 40 plates, each containing four line drawings of objects or actions. For each plate, the child heard an English word spoken by the test giver and then circled one of the four drawings which

best illustrated the spoken stimuli (Max = 40).

Pre-tests of Word Familiarity

Prior to the word-learning task, each child was first tested on his or her prior knowledge of the English words employed in the task. There were two pre-tests of word familiarity: rhyming word familiarity and target word familiarity. Children assigned to the Pre-Exposure word-learning task took both of the tests. Children assigned to the Direct word-learning task took only the target word familiarity test.

Rhyming word familiarity. The purpose of the test was to know whether the child was familiar with the rhyming words used in each story in the Pre-Exposure task. The child was shown a group of four pictures, in which three pictures illustrated the rhyming words used in the story and one picture served as a distracter illustrating an irrelevant object. The test giver named one of the pictures and the child had to point to the picture named by the test giver. There was a total of 14 rhyming words in the stories.

Target word familiarity. The test assessed whether the child had an existing label for the target words to be learned. The child was shown a picture illustrating one of the target words and asked “What is this?” The child had to orally produce the English label for the picture presented (Max = 3 sets × 3 words = 9).

Pre-Exposure Word-learning Task

Materials

Stories. Children assigned to the Pre-Exposure task were told stories before they were taught new words. Three stories were created. Each story contained a number of words (e.g., *Dane, train, rain, brain, and plane*) which rhymed with the target words to be learned (e.g., *crane, pane, and vane*). The rhyming words were mostly selected from the basic 1200 words for elementary and junior high school students published by the Ministry of Education in 2004. The token of the recurring rhyming words in each story was ten, which was identical to the number of the occurrence of the rhyming words in the story used in Demke et al.’s (2002) study.

Target words. Three sets of target words were formed for children to learn. Each set contained three rhyming words (*crane, pane, vane; vat, mat, tat; stake, rake, sake*), which rhymed with the rhyming words in the stories. Earlier work on L1 phonological memory usually gave the participants five or six words to recall. The present study required the participants to learn three words as a set each time because the target words were new and nonnative to the participants. All the target words were picturable to minimize the effect of concreteness and imaginability in the learning of the words. The words were grouped in different ways according to the rhyming

conditions. In the Matched condition, each set of rhyming words were learned as a set. In the Mismatched condition, one word was randomly selected from each set and the three selected were learned as a set (e.g., *crane*, *vat*, and *stake*). The same pool of target words was also used in the Direct word-learning task. See Appendix B for the stimuli.

Procedure

Matched condition. The participants were seen individually in a quiet room in school. In the matched condition, each child was told stories containing the words that rhymed with the target words to be learned. For each set of target words, there were two learning trials. A trial consisted of a learning phase followed by a test phase. In the learning phase, the rhyming words in the story (e.g., *Dane*, *train*, *rain*, *brain*, and *plane*) were first introduced with pictures to the child. No printed forms were presented to the child. The test giver named each of the pictures twice and the child repeated each of the rhyming words following the model given by the test giver. After introducing the rhyming words, the test giver told the child the corresponding story with pictures (e.g., *Dane has a very beautiful train. But his train is broken in the rain. He is very sad. Someone tells him to buy a new train. So he thinks in his brain: should I take a train or a plane to buy a new train? Then he decides to take a plane*). Upon the completion of the story, the test giver taught the child the three rhyming target words (e.g., *crane*, *pane*, and *vane*). The three target words were introduced by three pictures, each of which illustrated one of the target words. The test giver named the three target pictures one by one three times. The child was required to repeat after the test giver three times. If the child mispronounced the target word, the test giver corrected the child only once. Accuracy of immediate repetition of the target words was recorded.

The test phase began immediately after the child had repeated the target words. Three outcome measures were administered in the test phase: an item recall test, a word production test, and a word recognition test, in that order. See outcome measures for details of the tests. After taking the three outcome measures, the child was asked two questions which probed into his or her understanding of the factual information of the story, such as ‘What beautiful thing does Dane have?’ and ‘Does Dane take a train or a plane finally?’ The questions were orally given in Chinese by the test giver and the child was encouraged to answer the question either in English or in Chinese. The story comprehension test was given only to make sure that the child paid attention to the stories; it was not put into analysis in the present study.

After two learning trials of the first set of target words, the test giver introduced the second set and the third set of target words following the same format.

Mismatched condition. The procedure for the mismatched condition was the same

as in the previous condition, except that each child was taught the words that neither rhymed among themselves nor rhymed with the words in the story. Each story began with an introduction of the rhyming words in the story (e.g., *Dane, train, rain, brain,* and *plane*), followed by the presentation of the story (e.g., *Dane has a very beautiful train...*). Then the test giver taught the child three target words. The three target words were randomly selected from each of the three sets of rhyming target words (e.g., *crane, vat,* and *stake*). Thus, the three target words learned as a set did not rhyme with each other. Only one (i.e., *crane* in this case) rhymed with the rhyming words presented in the story. In this spirit, children assigned to the Mismatched condition listened to the same stories and learned the same pool of target words used in the Matched condition, but there was a mismatch between the rhyming words in the story and the target words subsequently learned.

Direct Word-learning Task

Materials

The same pool of target words created for the Pre-exposure word learning task was used in the Direct word-learning task.

Procedure

In this task, the participants learned the same pool of new words but they learned the words directly, without being pre-exposed to a story. Again, there were two rhyming conditions: Matched and Mismatched.

Matched condition. For each set of target rhyming words, there were two learning trials. A trial consisted of a learning phase followed by a test phase. In the learning phase, the test giver taught the child the first set of rhyming target words (e.g., *crane, pane,* and *vane*), which were introduced by three pictures illustrating the three target words. The test giver named the three pictures one by one consecutively for three times, pointing to their corresponding pictures. The child was required to repeat each word three times following the model given by the test giver. If the child mispronounced the target word, the test giver corrected the child only once. The test phase began immediately after the child had repeated the target words. Three outcome measures were administered in the test phase: an item recall test, a word production test, and a word recognition test. The second and the third sets of target words were taught and tested following the same format.

Mismatched condition. The procedure was the same as that for the Matched condition, except that the words learned as a set did not rhyme with each other (e.g., *crane, vat,* and *stake*).

Outcome Measures

There were three outcome measures in the two word-learning tasks. The item recall test measured the child's item memory of the target words, which could be achieved without aligning word forms with meanings. The word production test assessed the child's word learning performances by eliciting overt articulatory responses from the child, which involved aligning word forms with meanings and thus tapped order memory of the target words. The word recognition test also measured the child's order memory of the target words, but it did not require oral production of the label.

Item recall. Each child was asked to freely recall the targets he or she had just learned. One point was awarded to each word that was correctly recalled. If the child failed to recall the target word or gave a wrong answer, the test giver did not give the child corrective feedback but said "okay" and proceeded to the next trial (Max = 3 sets \times 3 words \times 2 trials = 18).

Word production. Each child was shown a picture illustrating a target word and was asked "What is this?" The child had to orally produce the label for the corresponding picture. Given that the child had to line up verbal responses with their corresponding pictures, this test tapped the child's ability to hold information sequentially (i.e., order memory) (Max = 3 sets \times 3 words \times 2 trials = 18).

Word recognition. Each child was given three pictures illustrating the three target words at a time and was asked to point to the picture named by the test giver. The test was included to avoid the possibility that some children might have acquired the order information of the target words but were unable to produce the target words correctly (Max = 3 sets \times 3 words \times 2 trials = 18).

RESULTS

Preliminary Analysis

Accuracy of immediately repeating the target words following the model given by the test giver was first securitized to see whether there was noticeable deviance in the pronunciations of the target words. The accuracy of immediate repetition of the target words was high (ranging from 96% to 100%), indicating that most children did not have difficulty articulating the target words following an immediate model given by the test giver. Next, children's performances in the two pre-tests were examined to see whether there were group differences. The results of a one-way ANOVA indicated that there were no significant differences across the four groups of the participants on the scores of the target word familiarity test ($F(3, 116) = 0.73, p > .05$). Similarly,

children who were assigned to the Matched condition in the Pre-exposure word-learning task and those who were assigned to the Mismatched condition did not differ significantly in their prior knowledge of the rhyming words used in the stories ($t(58) = 0.23, p > .05$).

Effects of Rhyming on L2 Word Learning

Table 1 presents the descriptive statistics of the three outcome measures as a function of word-learning task and rhyming condition.

Table 1
Descriptive Statistics for the Outcome Measures

	Pre-Exposure		Direct		
	Matched	Mismatched	Matched	Mismatched	
Item recall	<i>M</i>	12.43	10.07	12.80	10.33
	<i>SD</i>	2.30	2.21	2.54	2.47
Word production	<i>M</i>	8.50	7.27	9.27	6.53
	<i>SD</i>	3.58	3.03	3.97	2.80
Word recognition	<i>M</i>	12.87	14.03	12.60	13.40
	<i>SD</i>	3.94	3.32	3.91	3.54

To understand the overall effect of rhyming on children's word learning performances, three sets of 2 Task (Pre-Exposure vs. Direct) \times 2 Rhyming (Matched vs. Mismatched) ANOVAs with Task and Rhyming as between-subjects factors were conducted separately for the three outcome measures, i.e., item recall, word production, and word recognition. The results showed that there were no significant effects of interaction between Task and Rhyming for the three outcome measures ($F(1, 116) = 0.01$ for item recall, $F(1, 116) = 1.48$ for word production, and $F(1, 116) = 0.07$ for word recognition, all $ps > .05$). There were also no significant effects of Task, indicating that pre-exposure to rhyming words did not affect item recall, production or recognition of the target words ($F(1, 116) = 0.53$ for item recall, $F(1, 116) = 0.00$ for word production, and $F(1, 116) = 0.45$ for word recognition, all $ps > .05$). In contrast, there was a significant main effect of Rhyming for item recall ($F(1, 116) = 30.86, p < .05$) and for word production ($F(1, 116) = 10.37, p < .05$), with better performances observed in the Matched condition than in the Mismatched condition. For word recognition, the rhyming effect was not significant ($F(1, 116) = 2.14, p > .05$).

To sum up, the results from the ANOVAs revealed that Rhyming had an effect in item recall and word production, indicating that phonological manipulation in the

rime components of the new words facilitated L2 new word learning, particularly when the task demanded the production of the target words (i.e., item recall and word production). The Task effect was not significant in any of the outcome measures, indicating that pre-exposure to rhyming words did not enhance L2 word learning.

To further examine the unexpected finding that pre-exposure to the stories had no effect on word learning, we conducted post-hoc *t*-tests. As mentioned earlier, children in the Mismatched condition of the Pre-Exposure task learned three target words, one of which rhymed with the rhyming words embedded in the story though the other two did not. If pre-exposure to the rhyming words facilitated subsequent word learning, then children should perform better in the learning of the rhyming target word than in the learning of the other two. We compared children's scores of the rhyming target word with the average scores of the two non-rhyming target words for each of the outcome measures. The results of the *t*-tests revealed that there was no significant difference between the rhyming target word and the two non-rhyming target words in item recall ($t(58) = -0.18, p > .05$), word production ($t(58) = -0.53, p > .05$), or word recognition ($t(58) = -0.42, p > .05$).

One may argue that the lack of the Pre-Exposure effect might be due to unfamiliarity with the rhyming words embedded in the story among some children. Thus, we compared children with high scores in the rhyming word familiarity test (those who scored 10 or more than 10 out of 14) in the Matched condition of the Pre-Exposure task with children in the Matched condition of the Direct task. The *t*-test allowed for an examination of whether children who were pre-exposed to *familiar* rhyming words would learn new words better than children who learned the same set of new words but who were not pre-exposed to the rhyming words. The results of the *t*-test indicated that children in the Matched condition of the Pre-Exposure task and children in the Matched condition of the Direct task did not differ significantly in item recall ($t(37) = -0.20, p > .05$), word production ($t(37) = -0.29, p > .05$), or word recognition ($t(37) = -1.29, p > .05$). The results suggested that the lack of phonological priming was not attributable to the unfamiliarity with the rhyming prime words.

DISCUSSION

This study investigated the effect of exposure to rhyming words on new word learning. The results revealed that pre-exposure to rhyming words embedded in a story did not affect children's subsequent new word learning. However, learning rhyming words together facilitated item recall and word-referent association whether

there was pre-exposure to the rhyming words or not. But the beneficial effect on order memory, that is, mapping a word onto its corresponding referent, was limited to tasks requiring oral production.

The Effect of Pre-Exposure to Rhyming Words

The lack of the phonological priming effect was inconsistent with the studies which have reported a facilitative priming effect in new word learning (Merriman & Marazita, 1995), though it was consistent with the findings reported by Demke et al. (2002). In Merriman and Marazita's study, the effect of hearing similar-sounding words was examined on young 2-year-olds' disambiguation of novel noun reference. The children were pre-exposed to a story which contained some words sharing the initial phoneme (e.g., *little*) and the rime unit (e.g., *cat*) with the target word to be learned (e.g., *lat*). Children pre-exposed to the similar-sounding words were more likely to select an unfamiliar rather than a familiar object as the target word's referent. But this was not the case in Demke et al.'s study, where children were asked to name the new object verbally. According to Demke et al., the lack of priming in their study might be attributable to insufficient pre-exposure to the rhyming words. However, this did not seem to be the case in the current study. In Demke et al.'s study, children were pre-exposed to 10 tokens of rhyming words before they learned the new word. In the current study, the children first repeated the rhyming words twice before listening to the stories, where the rhyming words were presented again. In total, the children were pre-exposed to at least 30 tokens of rhyming words before learning the new words. However, we still found no evidence of phonological priming.

One may argue that the lack of phonological priming in the present study might result from children's unfamiliarity with the rhyming words used in the stories. As has been pointed by Slowiaczek et al. (1987), pseudoword or unfamiliar primes yield a smaller priming effect than word primes. To assess the effect of prime word familiarity on the priming effect, we selected a subgroup of participants who were assigned to the Matched condition in the Pre-Exposure task and who obtained high scores in the rhyming word familiarity test. Their performances in the three outcome measures were compared with the performances of children who were assigned to the Matched condition in the Direct task. The two groups of children learned the same set of rhyming target words but differed in whether they were pre-exposed to the rhyming words embedded in the stories. Still, there was no evidence that pre-exposure to familiar, known rhyming words affected word learning. Thus, the lack of priming effect in the current study did not seem to be attributable to children's unfamiliarity with the rhyming words embedded in the stories.

A close comparison of the present study with Merriman and Marazita's indicated

that the lack of phonological priming might be attributable to task demands. In Merriman and Marazita's study, the child was asked to select a picture upon hearing a new word after hearing similar-sounding words in a story context. The child chose the picture depicting a new, unfamiliar object more often than the ones depicting old objects, indicating that pre-exposure to rhyming words facilitated the disambiguation of noun references. However, the results should be interpreted with caution. Numerous studies have shown that young children tend to map a new word onto a new, unfamiliar object whether they are pre-exposed to rhyming words or not, a principle which is often dubbed as novel-name-to-nameless-category principle (e.g., Golinkoff, Hirsh-Pasek, Bailey, & Wenger, 1992). It is possible that the phonological priming effect obtained in Merriman and Marazita's study is an artifact of this tendency to choose a new, unfamiliar object upon hearing a new label.

In addition, the child participants in the present study had to orally produce the label (as in item recall and word production) or hold multiple new phonological forms distinct in memory while mapping them onto their appropriate referents (as in recognition and production). These tasks apparently put heavier demands on phonological representations than the one used in Merriman and Marazita's study. It seems that phonological priming, if any, sustains only to the extent of facilitating the disambiguation of the objects. It is not sufficient to support word learning in a task like the one employed in the current study and the one employed in Demke et al. (2002), where a highly-specified phonological representation was required for overt production or for disambiguating among multiple word forms (rather than word referents).

The Effect of Rhyming among the Target Words

Do children learn a set of rhyming words better than a set of non-rhyming words? The results of the item recall test and the production test indicated that when children learned rhyming words together, they freely recalled more novel words and mapped more novel words onto their corresponding referents than when they learned words that did not rhyme. However, the facilitative effect of rhyming is not evident in the recognition test.

When item memory of new words is considered, our finding that learning rhyming words together facilitated free recall and production of the new words is consistent with memory studies, which revealed an item recall advantage in memory of rhyming words (Fallon et al., 1999; Gupta et al., 2005; Nimmo & Roodenrys, 2004). The facilitative effect of rhyming in item recall reflects the special status of rimes in English. In English, the most salient psycholinguistic boundary within a syllable is the boundary between the onset and the rime (e.g., Hartley & Houghton,

1996; Kessler & Treiman, 1997; Treiman & Kessler, 1995). The onset-rime units have been found to play a significant role in a wide range of linguistic operations, such as phonological awareness (Treiman & Kessler, 1995), memory errors (Treiman, 1995), and lexical organization (de Cara & Goswami, 2002; Foy & Mann, 2009). Acoustically, the rime unit is even more salient than the onset because it contains the vowel, the peak of sonority in a syllable. Accordingly, the facilitative effect of rhyming in word learning might be attributed to the repeated activation of the sonority peak in the words to be learned, which functions as a salient category cue for the construction of the phonological representations of the target words during the process of encoding and recalling.

When the order memory of the new words is considered, the results of the word production test indicated that learning rhyming words together helped the learner map the target words onto their corresponding referents in an orderly manner. On the first sight, our finding did not seem to be in accordance with the results of previous studies which have revealed a confusion effect of phonological similarity on order memory (Nairne & Kelley, 1999; Nimmo & Roodenrys, 2004, 2005; Poirier & Saint-Aubin, 1996). What has offset the potential confusion effect of phonological similarity on the processing of order information? As described earlier, the confusion effect was mostly documented in a word recall task of L1 words. The subjects in those studies are required to recall a list of old familiar words. They do not have to construct new phonological forms in memory when performing the word recall task. Rhyming does not seem to have an additional advantage for order memory in recalling a list of old familiar words. Instead, it produces a confusion effect because it reduces the overall distinctiveness of the already-known rhyming words in the list. But in L2 word learning context, the learners have to encode new phonological forms and map the forms onto their corresponding referents. Constructing phonological forms for new words may be less demanding when the new words share the same phonological components than when the new words have various phonological components. Research have shown that nonwords or foreign language words are easier to repeat and to recall when they contain familiar sound sequences than when they are composed of unfamiliar sound sequences (Gathercole, 1995; Service & Craik, 1993; Speciale, Ellis, & Bywater, 2004). The repetition of the rime unit in a list of new words increases redundancy between the phonological forms; the familiarity of the sound sequences within the words accumulates as the encoding process proceeds. As the construction of sounds becomes less demanding with the cue provided by the rhyming list, the lining up of the sounds with their referents becomes less demanding as well.

There is another reason that the phonological similarity among the rhyming

words in the present study did not impair order learning of the new words as would be predicted by the findings in the previous studies. In the previous studies which reported a detrimental similarity effect on the process of order information, the participants were given a list of five or six words for word recall. In the present study, the participants were given three words for new word learning. Thus, the number of the items to be ordered and lined up with the referents in the present study was relatively small when compared to that used in the previous studies. The smaller number of words to be recalled was expected to reduce memory load and thus might have reduced the potential confusion effect of phonological similarity on order memory.

One aspect of finding is worth mentioning. The shared rime unit among the target words appeared to have a specific beneficial effect on the productive aspect of word learning. The rhyming effect is evident in item recall and word production but not in word recognition. This is not surprising for beginning L2 learners, whose execution of articulators for foreign-sounding syllable has not reached automaticity. When rhyming words are learned together, the articulatory planning is executed for the one rime unit. The same planning can be readily used for the rime unit in another new word, making the production of the word easier. Thus, the advantage for constructing phonological representations for each of the individual rhyming items (i.e., the advantage of item memory) as well as the advantage for repeating the same articulatory plans might have masked and even overridden the potential detrimental effect of rhyming on order memory.

Summary and Future Directions

The results of the present study confirm the facilitative effect of rhyming on L2 word learning, though the evidence for phonological priming is not conclusive. Theoretically, the results help us understand how phonological priming and phonological similarity work in L2 learning context. Phonological priming may not sustain to the extent when the word learning task involves production of the new words or when there are multiple words to be learned. The confusion effect of phonological similarity commonly observed in the traditional memory task can be offset in L2 word learning context if the similarity is cast upon the rime unit. The repetition of the units of high sonority in words appears to support L2 new word learning, where phonological representations have to be constructed from scratch and the redundancy in the salient units of target words may help reduce the demands in the construction of phonological representations. Pedagogically, the results point to a potential way by which new L2 vocabulary items can be introduced. If possible and appropriate, the teacher may consider to present words which share the same rime

units as a group to assist the construction and memory of stable and detailed phonological forms for the new words. Introducing rhyming words together can be viewed as a mnemonic alternative to the keyword method. However, the number of the rhyming words taught at a time has to be limited as too many rhyming words may cause an undesirable confusion effect.

As in all statistical analyses, it is always hard to interpret null effects. It is unclear whether the null effect of phonological priming in the present study represents a genuine null effect or an artifact of insensitive primes. Future studies may maximize the similarities between the prime and the target, for example, by employing primes sharing the onset and the rime unit with the target words at the same time. Additionally, future studies may take the children's L1 into consideration in the investigation of the phonological priming effect. In Chinese, the predominant syllable structure is CV. There are some CVC syllables, but the coda consonant in the CVC syllables must be the alveo-dental nasal [n] or the velar nasal [ŋ] (Tseng, 2005). Mandarin Chinese does not have any consonant clusters and has a relatively simple coda structure when compared with English, suggesting the dominant role of the CV_ unit in Chinese than the rime unit. Given that how a language is processed is influenced by how the speaker's L1 is organized (e.g., Ben-Dror, Frost, & Bentin, 1995; Caravolas & Bruck, 1993; Cheung, Chen, Lai, Wong, & Hills, 2001), it is possible that Chinese children are more sensitive to the CV_ unit than the rime unit and thus pre-exposure to words sharing the CV_ unit with the target words may result in a greater priming effect than pre-exposure to words sharing the rime unit. Thus, future studies may also use primes sharing the CV_ unit with the target words to further examine the potential role of phonological priming on L2 new word learning.

REFERENCES

- Anderson-Inman, L., Knox-Quinn, C., & Horney, M. A. (1996). Computer-based study strategies for students with learning disabilities: Individual differences associated with adoption level. *Journal of Learning Disabilities, 29*, 461-484.
- Baddeley, A., Gathercole, S., & Papagno, C. (1998). The phonological loop as a language learning device. *Psychological Review, 105*, 158-173.
- Baddeley, A., Papagno, C., & Vallar, G. (1988). When long-term learning depends on short-term storage. *Journal of Memory and Language, 27*, 586-595.
- Ben-Dror, I., Frost, R., & Bentin, S. (1995). Orthographic representation and phonemic segmentation in skilled readers: A cross-language comparison. *Psychological Science, 6*, 176-181.

- Bowles, N. L., & Poon, L. W. (1985). Effect of priming in word retrieval. *Journal of Experimental Psychology: Learning, Memory and Cognition*, *11*, 272-283.
- Caravolas, M., & Bruck, M. (1993). The effect of oral and written language input on children's phonological awareness: A cross-linguistic study. *Journal of Experimental Child Psychology*, *55*, 1-30.
- Cheung, H., Chen, H.-C., Lai, C. Y., Wong, O. C., & Hills, M. (2001). The development of phonological awareness effects of spoken language experience and orthography. *Cognition*, *81*, 227-241.
- Collins, A. F., & Ellis, A. W. (1992). Phonological priming of lexical retrieval in speech production. *British Journal of Psychology*, *83*, 375-388.
- Conrad, R. (1964). Acoustic confusions in immediate memory. *British Journal of Psychology*, *55*, 75-84.
- Conrad, R., & Hull, A. J. (1964). Information, acoustic confusion and memory span. *British Journal of Psychology*, *55*, 429-432.
- de Cara, B., & Goswami, U. (2002). Similarity relations among spoken words: The special status of rimes in English. *Behavior Research Methods, Instruments, & Computers*, *34*, 416-423.
- Demke, T. L., Graham, S. A., & Siakaluk, P. D. (2002). The influence of exposure to phonological neighbours on preschoolers' novel word production. *Child Language*, *29*, 379-392.
- Fallon, A. B., Groves, K., & Tehan, G. (1999). Phonological similarity and trace degradation in the serial recall task: When CAT helps RAT, but not MAN. *International Journal of Psychology*, *34*, 301-307.
- Foil, C. R., & Alber, S. R. (2002). Fun and effective ways to build your students' vocabulary. *Intervention in School & Clinic*, *37*, 131-139.
- Foy, J. G., & Mann, V. A. (2009). Effects of onset density in preschool children: Implications for development of phonological awareness and phonological representation. *Applied Psycholinguistics*, *30*, 339-361.
- Gathercole, S. E. (1995). Is non-word repetition a test of phonological memory or long-term knowledge? It all depends on the non-words. *Memory and Cognition*, *23*, 83-94.
- Gathercole, S. E., & Baddeley, A. D. (1993). *Working memory and language*. Hove, East Sussex: Erlbaum.
- Gathercole, S. E., Hitch, G. J., Service, E., & Martin, A. J. (1997). Phonological short-term memory and new word learning in children. *Developmental Psychology*, *33*, 966-979.
- Golinkoff, R. M., Hirsh-Pasek, K., Bailey, L., & Wenger, N. (1992). Young children and adult use lexical principles to learn new nouns. *Developmental Psychology*,

28, 99-108.

- Gupta, P., Lipinski, J., & Aktunc, E. (2005). Reexamining the phonological similarity effect in immediate serial recall: The roles of type of similarity, category cuing, and item recall. *Memory & Cognition*, 33, 1001-1016.
- Hartley, T., & Houghton, G. (1996). A linguistically constrained model of short-term memory for nonword. *Journal of Memory and Language*, 35, 1-31.
- Hu, C.-F., & Schuele, C. M. (2005). Learning nonnative names: The effect of poor native phonological awareness. *Applied Psycholinguistics*, 26, 343-362.
- Kessler, B. & Treiman, B. (1997). Syllable structure and the distribution of phonemes in English syllables. *Journal of Memory and Language*, 37, 295-311.
- Lewis, M. (1993). *The lexical approach: The state of ELT and a way forward*. Hove, England: Language Teaching Publications.
- Lupker, S. J., & Williams, B. A. (1989). Rhyme priming of pictures and words: A lexical activation account. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 15, 1033-1046.
- McEvoy, C. L. (1988). Automatic and strategic processes in picture naming. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 14, 618-626.
- Merriman, W. E., & Marazita, J. M. (1995). The effect of hearing similar-sounding words on young 2-year-olds' disambiguation of novel noun reference. *Developmental Psychology*, 31, 973-984.
- Michas, I. C., & Henry, L. A. (1994). The link between phonological memory and vocabulary acquisition. *British Journal of Developmental Psychology*, 12, 147-163.
- Moore, J. C., & Surber, J. R. (1992). Effects of context and keyword methods on second language vocabulary acquisition. *Contemporary Educational Psychology*, 17, 286-292.
- Nairne, J. S., & Kelley, M. R. (1999). Reversing the phonological similarity effect. *Memory & Cognition*, 27, 45-53.
- Nattinger, J., & DeCarrico, J. (1992). *Lexical phrases and language teaching*. Oxford: Oxford University Press.
- Nimmo, L., & Roodenrys, S. (2004). Investigating the phonological similarity effect: Syllable structure and the position of common phonemes. *Journal of Memory and Language*, 50, 245-258.
- Nimmo, L., & Roodenrys, S. (2005). The phonological similarity effect in serial recognition. *Memory*, 13, 773-784.
- Papagno, C., Valentine, T., & Baddeley, A. (1991). Phonological short-term memory and foreign-language vocabulary learning. *Journal of Memory and Language*, 30, 331-347.

- Poirier, M., & Saint-Aubin, J. (1996). Immediate serial recall, word frequency, item identity, and item position. *Canadian Journal of Experimental Psychology, 50*, 408-412.
- Ranger, L. (1995). Improving reading comprehension through a multi-faceted approach utilizing drama. Retrieved June 19, 2006, from ERIC database.
- Service, E., & Craik, F. I. M. (1993). Differences between young and older adults in learning a foreign vocabulary. *Journal of Memory and Language, 32*, 608–623.
- Shostak, J. (2002). *The value of direct and systematic vocabulary instruction*. Sadlier-Oxford Professional Development Series, 7. New York, NY: William, H. Sadlier.
- Slattery, M., & Willis, J. (2001). *English for primary teachers*. Oxford: Oxford University Press.
- Slowiaczek, L. M., Nusbaum, H. C., & Pisoni, D. B. (1987). Phonological priming in auditory word recognition. *Journal of Experimental Psychology: Learning, Memory and Cognition, 13*, 64-75.
- Speciale, G., Ellis, N. C., & Bywater, T. (2004). Phonological sequence learning and short-term store capacity determine second language vocabulary acquisition. *Applied Psycholinguistics, 25*, 293-321.
- Treiman, R. (1995). Errors in short-term memory for speech: A developmental study. *Journal of Educational Psychology, 21*, 1197-1208.
- Tseng, S. C. (2005). Syllable contractions in a Mandarin conversational dialogue corpus. *International Journal of Corpus Linguistics, 10*, 63-83.
- Treiman, R., & Kessler, B. (1995). In defense of an onset-rime syllable structure for English. *Language and Speech, 38*, 127-142.
- Watkins, M. J., Watkins, O. C., & Crowder, R. G. (1974). The modality effect in free and serial recall as a function of phonological similarity. *Journal of Verbal Learning and Verbal Behavior, 13*, 430-447.
- Wickelgren, W. A. (1965). Short-term memory for phonemically similar lists. *American Journal of Psychology, 78*, 567-574.
- Wilshire, C., & Saffran, E. (2005). Contrasting effects of phonological priming in aphasic word production. *Cognition, 95*, 31-71.

APPENDIX A

Questionnaire of Background Information

班級: _____ 年 _____ 班

姓名: _____

生日: 民國 _____ 年 _____ 月 _____ 日

小朋友你好，下面有幾個關於學習英文的問題，請根據你學習英文的狀況，勾選出最符合自己的情況，謝謝你的合作。

1. 請問你從什麼時候開始學英文?

- 幼稚園之前 幼稚園小班 幼稚園中班 幼稚園大班
 一年級 二年級 三年級 四年級

2. 有沒有跟外國老師學過英文?

- 有 沒有 (勾選有的請繼續回答問題 3)
(勾選沒有的請回答問題 4)

3. 跟外國老師學英文學了多久?

- 不到一年 一至二年 二至三年 三年以上

4. 現在有沒有參加課外英文補習?

- 有 沒有 (勾選有的請繼續回答問題 5)

5. 課外英文補習一個星期上課幾次? _____ 次

一次上課多久? _____ 小時

6. 有沒有曾經在講英語的國家居住過 (例如: 英國, 美國, 澳...等)?

- 有 沒有 (勾選有的請繼續回答問題 7)

7. 居住了多久?

- 不到一年 一至二年 二至三年 三年以上

APPENDIX B

Stimuli for the Matched Condition of the Pre-exposure Word Learning Task

	Target words	Stories
Set 1	crane, pane, vane	<i>Dane</i> has a very beautiful <i>train</i> . But his <i>train</i> is broken in the <i>rain</i> . He is very sad. Someone tells him to buy a new <i>train</i> . So he thinks in his <i>brain</i> : should I take a <i>train</i> or a <i>plane</i> to buy a new <i>train</i> ? Then he decides to take a <i>plane</i> .
Set 2	vat, mat, tat	A long time ago, there is a <i>fat cat</i> . His name is <i>Pat</i> . <i>Pat</i> wears a <i>hat</i> all the time and he likes to <i>chat</i> with his friends. His favorite food is <i>rat</i> and <i>bat</i> . He likes to eat <i>rat</i> and <i>bat</i> very much!
Set 3	stake, rake, sake	<i>Pake</i> likes to play with his friends. <i>Pake</i> also likes to eat <i>cake</i> , especially when she <i>wakes</i> up in the morning. Every morning, <i>Pake</i> likes to go to the <i>lake</i> and <i>bake</i> the <i>cake</i> with his friends. They all like to <i>bake</i> and eat <i>cakes</i> .

押韻字對台灣學童學習英語新字的影響

摘