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COMPARISON OF WORD RECOGNITION STRATEGIES IN EFL ADULT LEARNERS: ORTHOGRAPHY VS. PHONOLOGY

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ABSTRACT

In an attempt to compare how orthography and phonology interact in EFL learners with different reading abilities, online measures were administered in this study to two groups of university learners, indexed by their reading scores on the Test of English for International Communication (TOEIC). In terms of *accuracy*, the less-skilled learners performed significantly more poorly than the skilled learners in Nonword Reading, Word Reading, and Rhyme Detection. With regard to *reaction times*, the less-skilled learners also responded significantly more slowly while they read nonwords and vocabulary words. Nevertheless, both groups performed comparably on Rhyme Detection when asked to decide whether word pairs varied in their orthographic (O) and phonological (P) similarity (S) or difference (D). A further investigation on the test items revealed that the two groups performed comparably in accuracy only when a pair of words was orthographically similar and phonologically similar (OSPS). Intriguingly, the most significant between-group difference occurred when a pair of words was orthographically similar but phonologically different (OSPD), suggesting that orthography played a bigger role in word recognition among less-skilled learners. In contrast, the two groups performed non-differentially in reaction times only when a pair of words was orthographically different but phonological similar (ODPS), suggesting that the skilled learners relied more on phonology in word recognition and might have slowed down as a consequence. Taken together, the results seem to suggest that the less-skilled learners had significantly weaker word recognition skills and phonological representations of English words, which might be attributed to their over-reliance on orthography during word recognition processes.

Key Words: EFL, orthography, phonology, word recognition, university learners

It is noted in classrooms where English is taught as a foreign language (EFL) that learners at low proficiency levels are often less efficient in reading texts out loud correctly and fluently (Borodkin & Faust, 2014). There are several possible reasons. One is that they are unfamiliar with the vocabulary words or the content of texts, but it is also possible that they simply do not have a good grasp of phonological representations of English words. As language entails elements which determine its orthographic and phonological structures, different writing systems require readers to develop different processing strategies for word recognition to take place (Kuo et al., 2003; Perfetti, Cao, & Booth, 2013). For example, learning to read English requires learners to associate an alphabetic letter or a few alphabetic letters, i.e., unit of writing, with a phoneme, i.e., unit of speech. While the large number of words and morphemes is produced from a small set of reusable letters, the correct mappings between units of writing and units of speech are essential to learning to read English. In contrast, there is no grapheme-phoneme correspondence in Chinese characters. Instead, a given syllable is often associated with many morphemes due to the high level of homophony while the graphic components in the Chinese written language often contain cues to pronunciation, meaning, or both. Given such abundant phonetic and semantic cues, learners learning to read Chinese need to develop spatial-visual skills to cope with its orthographic complexities. It leaves one wondering whether skilled and less-skilled L2[1] learners distinguish themselves on strategies of word recognition as a result of their orthographic-phonological knowledge, especially when the orthographies and phonologies of their two languages vary greatly.

LITERATURE REVIEW

Key Factors of Successful Word Recognition in English

The primary function of a writing system is to transcribe its spoken language (Shankweiler & Fowler, 2004). Nevertheless, different orthographies vary in the transparency of their grapheme-phoneme mappings. In more transparent orthographies, the grapheme-phoneme conversions are direct and learners can easily predict the pronunciation

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[1] EFL and L2 are used interchangeably in this paper.

of a word by applying such conversion rules (Ehri & Roberts, 2006; Perfetti & Dunlap, 2008). The orthographic forms are thus closely connected with the phonological codes. In contrast, in more opaque orthographies, the grapheme-phoneme mappings are less consistent and learners sometimes need to learn pronunciations of some irregularly spelled words. The orthographic forms are, comparatively, less consistently associated with the phonological representations in opaque orthographies (Cheung, McBride-Chang, & Chow, 2006; Tzeng, 2002). More transparent orthographies can be exemplified by Spanish and Italian while Chinese is labeled as one of the most opaque orthographies in the world. Along the continuum of orthographic transparency, the closeness of the orthographic-phonologic connection is most apparent in alphabetic languages, where graphemes are mapped onto phonemes though to different degrees in different orthographies.

Learning to read an alphabetic language requires an effortful application of the alphabetic knowledge on the part of novice readers (Ehri, 2005). Equipped with at least partial knowledge of letter-sound correspondence rules in a given orthography, beginning readers can attempt sounding graphemes out into phonemes. With practice, beginners become more spontaneous in the mapping procedures when they encounter new words if the mappings between graphemes and phonemes are correctly and consistently formed. Once children understand that spoken words are composed of smaller sound units such as syllables and phonemes, they are more likely to crack the codes in the written language. A few exposures to the new words in different contexts will enable the young learners to bind the spellings to their pronunciations in memory along with their meanings. In other words, the quality of phonological representations—familiarization with a word's pronunciation—has a great impact on children's ability in word learning and recognition.

One way to assess an individual's phonological representations, or grapheme-phoneme mappings in a given orthography, is pseudoword naming. When people read a nonsense word, they have to first recognize the print letters and apply the mapping rules which they generalize largely from known words before they can decode the letters phonologically into speech forms. The same decoding procedures apply when learners read unfamiliar words. In light of the essentiality of mapping principles in word learning, pseudoword reading is found associated with lexical knowledge in the early stages of acquiring English (Warmington & Hulme, 2012). Poor decoders performed poorly on not only word reading but also oral reading rate (Eason, Sabatini, Goldberg, Bruce, & Cutting, 2013). The association between decoding and vocabulary is reciprocal because children with a larger vocabulary consistently outperformed those with a smaller vocabulary in decoding measures (Lee, 2011). When measured in adults, decoding ability was connected with their passage comprehension (Binder & Lee, 2012). Consequently, decoding is associated with reading not only at lexical but also at text levels. Nevertheless, strong correlations are also found between decoding and phonological awareness[2] since the application of alphabetic knowledge depends largely on an awareness of phonemes, the smallest unit of speech. Among the Grade 4 learners, phonemic awareness was the strongest correlate of nonword reading (Warmington & Hulme, 2012). Younger learners with lower phonemic awareness had more difficulty naming unfamiliar words because it was likely that they lacked necessary skills in decoding the words phonologically (Conrad & Levy, 2011; Gilbert, Compton, & Kearns, 2011).

On the other hand, phonological awareness is another key factor for learning to read alphabetic scripts and its importance is manifested in several aspects. For example, phonological awareness is a better predictor in predicting reading skills of elementary school children than other cognitive abilities, such as digit span, reading speed, and general ability, whether the orthographies are consistent or inconsistent (Caravolas, Volín, & Hulme, 2005). In a similar vein, phoneme awareness was more strongly correlated with performance on phonological and orthographic processing measures than was rapid serial naming (Rakhlin, Cardoso-Martins, & Grigorenko, 2014). The fact that a specific deficit in phonological processing is present and persistent in dyslexic adult learners further marks its significance in learning to read opaque English orthography (Miller et al., 2006; Parrila, Georgiou, & Corkett, 2007).

Among a range of large and small phonological units, phoneme awareness reflects better-specified phonological representation, which in turn assists learners in making generalizations about the mappings between graphemes and phonemes. Consequently, phoneme awareness is qualified as both a concurrent and longitudinal predictor of young children's literacy success (Hulme et al., 2002; Oakhill & Cain, 2012).

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[2] Phonological awareness is a more encompassing term, referring to an ability to identify and manipulate a range of sublexical sounds, such as rhymes, onset-rimes, and phonemes.

All in all, the association of phonemic awareness with reading may lie in the close connection between letters and sounds since learning to read an alphabetic language in the initial stage has a lot to do with decoding the orthography phonologically (Ehri, 2005).

Reading Behavior of Logographic-L1 Readers

Chinese is both orthographically and phonologically different from English. In terms of orthography, in contrast to a small number of reusable letters in English, the Chinese language has a large number of graphic components, some of which contain phonetic or semantic information while some others are meaningless and unpronounceable (Chen, Shu, Wu, & Anderson, 2003). Composed of different graphic components, Chinese characters can be roughly classified into simple characters (e.g., 山，女, and 口) which are not further divisible and compound characters (e.g., 崧，姥, and 叭) which often contain semantic information, phonological information, or both. With regard to phonology, a syllable is mapped to a Chinese character at the lexical level, rather than at the sub-lexical level, and, unlike an English word, a Chinese character does not contain representations of phoneme segments (He, Wang, & Anderson, 2005). At first glance, the close orthographic-phonologic relationship might seem loose in Chinese; however, many Chinese compound characters contain phonetic radicals which provide complementary cues in character naming.

In principle, a Chinese *simple* character represents a morpheme which allows a rapid access to semantic information. Looking for semantic information in orthography was consequently more spontaneous in Chinese reading to beginning readers even though they naturally interpreted orthography as representation of sounds (Cheung, Chan, & Chong, 2007). At the initial stage of Chinese reading acquisition, learners must connect the closely bound morpheme and meaning with its corresponding pronunciation by rote memory. As a result of the abundant constituent components and orthographic complexities, writing characters by hand is made compulsory in learning to read and write Chinese in that it strengthens storage of orthographic forms of Chinese characters in memory and leads to better performance on word recognition and character-meaning links (Guan, Liu, Chan, Ye, & Perfetti, 2011). The more critical role of orthography in Chinese reading is thus demonstrated, in strong contrast to a greater influence of phonology to English reading.

It is highly likely that the orthographic complexities in Chinese characters force young children to focus directly on the visual-orthographic features of the logographic script and facilitate their visual skills. Huang and Hanley (1995) administered a visual form discrimination test to groups of first graders from Taiwan, Hong Kong, and England. The participants were asked to match the target with its copy from among three foils. While the two Chinese-speaking groups performed comparably, they outperformed the English group. Similar findings that literacy experiences influence visual spatial skills are reported with younger learners. Hong Kong and Korean kindergartners were compared to their Israeli and Spanish counterparts on visual spatial relationships (McBride-Chang et al., 2011). The Chinese and Korean children demonstrated significantly more advanced visual skills, suggesting that writing systems may have a great impact on shaping children's visual-spatial skills.

As the number and complexity level of Chinese characters increase with years in school, an efficient system has to emerge to meet readers' request to recognize the large number of compound characters. Chinese children by late Grade 1 were able to allocate their preexisting knowledge and encode characters into familiar sub-lexical orthographic constituent components which served as units of character perception, whether the components did or did not provide phonetic or semantic information (Anderson et al., 2013). In addition, the phonetic components embedded in semantic-phonetic compound words also provide clues to their pronunciations (He et al., 2005). The studies suggest that not only orthographic-phonological recoding is involved in reading Chinese but also that phonological awareness does facilitate learning to read Chinese.

The phonetic component, unfortunately, is not always reliable in inferring the accurate sound of a new character even though it does provide useful but incomplete information about pronunciation (Chen et al., 2003). Scholars have used *regularity* and *consistency* to define the mappings between Chinese orthography and phonology, only to conclude that Chinese has less consistent mappings of phonetic radicals to syllables (Shu, Meng, & Lai, 2003). In fact, even though the unit of speech can be analyzed down to the phonemic level in some regions where a phonetic system is used to teach Chinese, the syllable is still the most salient unit of speech for the task of reading because every syllable maps onto a single Chinese character. As a result, onset-rime awareness, but not phoneme awareness, was proved to be more significantly related to Chinese reading among elementary school children even after the effects of IQ had been controlled for (Siok & Fletcher, 2001). Consequently, despite a substantial overlap in brain activity between processing logographic and alphabetic languages, more perceptual and attentional mechanisms were involved when Chinese characters were recognized, in comparison with alphabetic reading. Meanwhile, the higher brain activation was attributed to an orthographic factor—binding the features of spatial arrangement of the strokes and the stroke combinations in a square (Kuo et al., 2003, p. 726).

It is thus proposed that visual skills are more important than phonological awareness in learning to read Chinese (Taylor, 2002). For example, a battery of tasks was administered to first- and fourth-grade Chinese children to assess their vocabulary, phonological awareness, morphological awareness, syntactic understanding, and reading comprehension (Li, Anderson, Nagy, & Zhang, 2002). The morphological factor accounting for the variance of reading comprehension increased from G1 to G4 while the phonological factor decreased in contrast. In addition, the ability to correctly discriminate between homophones is associated with Chinese character recognition in older children (Siok & Fletcher, 2001). The discrimination ability further suggests that better visual-orthographic skills develop in Chinese readers as a function of the logographic script and serve as one valid predictor of Chinese reading ability. The findings altogether indicate that how word recognition is taught and shaped in a given script is highly likely to have a bearing on literacy development of its learners.

Impact of L1 Literacy Experience on L2 Reading

The previous review of reading strategies developed and employed by readers of various L1s provides perspectives on different demands of learning to read a given script. Given such different demands, when two written scripts do not share the same orthographic characteristics, those readers who are short of necessary word recognition skills might consequently become less efficient in processing L2 words. For example, Hamada and Koda (2008) recruited 17 Korean and 18 Chinese college-level ESL learners in the USA to examine whether L1 orthographic background affected L2 decoding efficiency and vocabulary acquisition. As the Korean Hangul script is typologically more similar to the English alphabetic script than the Chinese logographic script, it was hypothesized that the congruent L1 orthographic background would facilitate L2 decoding, which in turn would yield more efficient vocabulary acquisition in Korean participants. Results show that the Korean-L1 participants were indeed superior in both decoding and learning of pseudowords. In addition, the reaction times of pseudoword decoding in the Korean group were significantly correlated with the three recall tests in pseudoword learning while no such significant correlations were found in the Chinese group. The opposite patterns suggest that the two groups with different L1 orthographic backgrounds might have utilized the assembly-based decoding procedure to different degrees and that it was possible the Chinese participants were much less dependent on phonological processing when tackling the pseudowords. Given the performance of both groups, cross-language transfer of word processing strategies might have taken place during the pseudoword learning task.

Similar research that Chinese readers seem to be less efficient when they learn an alphabetic script as an L2, due to their underdeveloped orthographic-phonological knowledge, is reported. Wang, Koda, and Perfetti (2003) found that the Chinese-L1 participants relied less on phonological information and more on orthographic information in identifying English words than did the Korean-L1 participants. The two groups of adult English learners were recruited to examine the cognitive consequences of L1 literacy experiences on learning to read an alphabetic L2. The Chinese participants performed more poorly overall than did the Korean participants when they had to delete the designated phonemes orally in words. Also in the semantic category judgment, the Chinese-L1 participants made more errors that were phonologically incorrect but orthographically acceptable while the Korean-L1 participants were more significantly hindered by homophone foils. Given the fact that the two adult groups did not differ significantly in education levels, length of studying English in their homeland, and residency in the US, the discrepancy in Chinese participants' performance was attributed to incongruous transfer of reading strategies from nonalphabetic L1 to alphabetic L2. In other words, the incongruity in L1 and L2 print processing experiences might have resulted in unconsolidated phonological processing skills in L2 and placed the Chinese learners of English at a disadvantage.

In fact, the dependence of logographic-L1 readers on orthography is so heavy that the mere alternated visual shape of a word could disrupt their reading. Akamatsu (2003) investigated whether L1 orthographic features would affect L2 word recognition processing in reading by alternating letter cases in words. The Chinese and the Japanese participants were found to be more adversely affected by case alternation than was the Persian group in reading speed. The readers with nonalphabetic L1s were less efficient in processing constituent letters in an English word than those with an alphabetic L1 background in reading alternated-case text. The result suggests that the former participants relied more heavily on word shape information and paid little attention to intraword phonological information which the latter participants depended on for recognizing unfamiliar words.

However, given the linguistic elements encoded in the script, the reading strategies efficient for the L1 readers remain equally crucial to the other learners when they acquire it as a second or foreign language (Hu & Schuele, 2005; Lesaux & Siegel, 2003; Luk & Bialystok, 2008). Phonological processing is accountable for reading alphabetic scripts similarly among EFL learners whose L1 includes a logographic script. Kato (2009) recruited Japanese-L1 students who were studying in higher education in the UK and administered tests of reading comprehension, sentence processing, phonological processing, and orthographic processing to them. Under the three conditions—silent, tapping, and articulatory suppression—of a sentence processing task, all participants successfully understood the stimulus sentences up to almost 90% at least, suggesting that they were able to employ direct-visual coding strategies. But in contrast, their reading rates deteriorated significantly from the silent to the suppression conditions and the negative influence was greater for the less proficient readers than for the proficient readers, indexed by their reading comprehension scores. The decline in reading rates suggests that concurrent articulation of irrelevant verbal material might have inhibited readers from the use of acoustic information, i.e., phonological processing of words, during reading. When the reading rates of both groups were significantly slowed down under the tapping and articulatory suppression conditions, it could be reasonably assumed that phonological processing might have contributed significantly to silent reading rates particularly in the proficient readers. Phonological processing is so critical to reading alphabetic scripts that it will no longer contribute to reading comprehension or fluency only when the learners are equipped with efficient word-level reading skills (Yaghoub-Zadeh, Farnia, & Geva, 2012).

THE PRESENT STUDY

Even though Chinese-L1 learners of English consistently exhibit less efficient orthographic-phonological knowledge and poorer phonological processing abilities, possibly due to the constraints in their L1, it is not clear to what extent the L1-L2 processing discrepancies might affect them in learning to read the alphabetic English script. The present study aims to explore whether skilled and less-skilled university learners of English develop different reading strategies for word recognition in relation to their orthographic-phonological knowledge. As one aim of the study is to compare how orthography and phonology interact among the EFL university learners, not only accuracy but also fluency, i.e., reaction times, of experimental tasks will be recorded as support. The present study aims to answer the following research questions.

1. How do the EFL university students at different reading levels vary on Word and Nonword Reading?
2. How do orthographic and phonological information interact on Rhyme Detection in the two EFL groups?
3. Which information, orthographic or phonological, plays a more dominant role in word recognition in the skilled and less-skilled groups respectively?
4. Are Word and Nonword Reading associated with Rhyme Detection in the skilled and less-skilled EFL learners respectively?

In light of the literature reviewed above, learning to read depends greatly on word recognition skills in a given language. Even though previous research has shown that Chinese-L1 learners of English might be short of sufficient skills in English literacy acquisition, such as efficient phonemic awareness or adequate alphabetic knowledge, it is believed that skilled learners are more likely than less-skilled learners to develop necessary efficiency in reading because their better performance in Word and Nonword Reading would act as support. In contrast, constrained by the linguistic elements in the Chinese writing system and a lack of necessary support from L2 literacy skills, the less-skilled EFL learners might be more adversely affected by possible transfer of visual-orthographic skills from L1 and have difficulty developing proper reading strategies for L2.

METHOD

Participants

Fifty-four university students were recruited from a private university in northern Taiwan and divided into two groups, indexed by their TOEIC reading scores (see Table 1). The less-skilled group (*M* = 166.67, *SD* = 27.03) had a mean reading score equivalent to that of A2 Waystage of the Common European Framework of Reference (CEFR) for Languages and the skilled group (*M* = 396.67, *SD* = 39.88) a mean reading score equivalent to that of B2 Vantage (Educational Testing Service, 2010). The big difference which existed between the skilled and less-skilled groups on TOEIC Reading scores was statistically significant, $F(1, 52) = 615.34$; $p < .001$, clearly demonstrating that the skilled learners had significantly better reading comprehension ability than did the less-skilled group.

Table 1

Background Information of Participants

	Group			
	Skilled (*n* = 27)		Less-Skilled (*n* = 27)	
Variable	*M*	*SD*	*M*	*SD*
TOEIC Reading	396.67	39.88	166.67	27.03
Age	21.43	1.23	22.72	2.33
Gender	total		total	
Female	20		9	
Male	7		18	
Disciplines				
Science	–		4	
Education	1		–	
Engineering	–		8	
Liberal Arts	–		3	
Foreign L&L	23		4	
International Studies	–		2	
Business & Management	3		6	

The 27 participants in the less-skilled group were recruited from remedial English courses, which were offered to the students who failed to reach the English graduation benchmark, i.e., the intermediate level on TOEIC. Meanwhile, the participants in the skilled group were recruited from courses taught in the university's English Department and also via internet posting. A majority of them were English majors and had taken the compulsory Linguistics course in their sophomore year while some might have further taken Phonetics. However, the concept of phonological awareness was not explicitly introduced in Linguistics lectures while it is also believed that the experimental measure Nonword Reading required participants to employ their letter-sound knowledge, which were more likely generalizations from known words (Ehri, 2005). All of them reached the English graduation benchmark and scored at least 310 out of 495 on the Reading Section. According to the CEFR reference levels, the skilled learners in the study could be labeled as independent or proficient language users who can at least understand main ideas of complex text on both concrete and abstract topics (Council of Europe, 2001). No IQ test was administered because the students had been screened in a national examination and, based on their performance, admitted to the private university. It is believed that their intelligence quotients would not vary greatly from each other, given the fact that none of them had performed extraordinarily on these experimental measures. In addition, according to the university's enrollment records, none of the participants was identified with difficulty in learning or reading.

Among the 54 participants, there were 29 female and 25 male students from seven different disciplines, including Science, Engineering, Education, Liberal Arts, Business and Management, Foreign Languages and Literatures, and International Studies. All of them are Chinese native speakers, including 50 local Taiwanese students, two Chinese students, and two from Macau and Hong Kong. Among the four overseas students, both Chinese students and one from Hong Kong were in the skilled group while the other from Macau was in the less-skilled group. The participants from overseas were included because no parallel Chinese measures of literacy skills were employed in the present study. Even though approaches to English instruction were different from region to region, the same could be said of the local Taiwanese students from different cities and counties. In addition, a further investigation into Nonword Reading performance of the two overseas students from Macau and Hong Kong revealed that the participant in the less-skilled group correctly decoded only 22 nonwords out of 40; however, it was not the lowest score in the group. Meanwhile, the skilled learner from Hong Kong scored 35, very close to the average score of the skilled group on Nonword Reading. Judging from the participants' performance on the task, the development of decoding ability might be more closely connected with their overall L2 proficiency levels, rather than singly with their L1 background.

Measures

Fifty-four university students were recruited from a The present study aimed to probe whether there was any difference between skilled and less-skilled learners in their word-reading behavior. All three measures were online tasks which required participants to recognize the orthographic information and activate phonological information or representations in their memory. However, oral production was required only in the Word and Nonword Reading tasks but not in Rhyme Detection. In the latter task, participants had to draw on the phonological representations of words stored in their minds without pronouncing them.

Word Reading Test (WRT). Quick Adult Reading Inventory (QARI; Chall, Roswell, Curtis, & Strucker, 2003; see Appendix A) was to assess learners' word reading proficiency by asking them to read 100 highly frequent English words. The inventory included two parallel forms, each of which contained 50 words of five different levels. The 100 words were divided into 10 lists. The words comprised different numbers of syllables, ranging from one to five. Words in List A in both forms were mostly monosyllabic and highly frequent words compared to those in the other lists. Level of difficulty increased as the list level increased. Another six trial items were used as examples to familiarize participants with the task.

Nonword Reading Test. The Nonword Reading Test (see Appendix B) was to assess learners' phonological decoding ability, which draws heavily on phonological processing as it involves the operation of grapheme-phoneme correspondences rules. There were 40 nonwords, half of which were adopted from the Nonword Reading Test (Snowling, Stackhouse, & Rack, 1986) and the other half from the Children's Test of Nonword Repetition (Gathercole, 1995). The nonwords adopted from Gathercole's list are longer and serve a good purpose because the letter strings strictly conform to the English phonotactic rules and are highly word-like. The nonwords were reprinted on separate A4 pieces of paper and separated into four lists. There were six trial items.

Rhyme Detection. Adopted from Kramer and Donchin (1987, see Appendix C), 60 pairs of words varying in their orthographic (O) and phonological (P) similarity (S) or difference (D) were selected to assess the participants' ability to recognize pairs of rhyme words. The combinations of rhyme pairs can be both orthographically and phonologically similar (OSPS), orthographically similar but phonologically different (OSPD), orthographically different but phonologically similar (ODPS), or both orthographically and phonologically different (ODPD). The 60 test items were randomly divided into four lists, in each of which all four combinations were included. There were eight trial items, similarly inclusive of all four combinations.

Procedures and Scoring

The three tasks were run in the DMDX program, a display system which simultaneously records participants' accuracy and fluency in responding to visual or/and auditory stimuli. Prior to the first test item of each list, a fixation marker "+" appeared in the center of the monitor to draw participants' attention to the beginning of a series of test items. As soon as the participants clicked the mouse to indicate their answer, a new test item appeared. A compulsory break was inserted between two test lists in each measure. Participants were free to decide how long they wanted a break. However, once a new list started, participants did not stop until all the test items in a list were answered. A time-out feature was employed in the tasks and a new item automatically appeared if the participants did not answer within 15 seconds.

Accuracy was automatically recorded for the task of Rhyme Detection, where a point was awarded to each correctly answered test item. In terms of reaction times, as soon as participants clicked the mouse, the timing stopped and the time spent on a test item was automatically recorded. In the other two tasks of Word and Nonword Reading, accuracy was manually rated by the experimenter and a native English speaker who had taught many years in Taiwan and recently retired, respectively. The digital recorder was placed on the desk and very close to the participants so that their oral responses were clearly recorded for later verification. But lax rules were applied in scoring. For example, if the nonwords were read correctly in terms of their pronunciation and stress but the participants consistently carried a local accent which was not confused with any existing phoneme in English, it was still regarded as a correct answer. In terms of reaction times for the two tasks, special care was taken so that participants behaved similarly with regard to when to click the mouse. The participants were instructed to delay their mouse-clicking until they completely finished reading a whole word or nonword. They were reminded not to click the mouse as soon as they uttered the first phoneme or syllable or in the middle of reading a word. If they did not know how to pronounce a word, they had to say clearly that they could not name it. The participants practiced how to properly click the mouse during trial items and were corrected or reminded during each compulsory break. The three tests took approximately 30 minutes to complete. All the experimental tasks were conducted on an Intel Core 2 Duo desktop in a quiet study room in the university where all participants were tested individually.

RESULTS

In an attempt to answer the research questions, independent measures multivariate analyses of variance were computed to summarize and compare the two groups' performance on accuracy (see Table 2) and reaction times (see Table 3). Pearson's correlations (see Table 4) were also run to test the hypothesis that stronger associations would be found in the skilled group as a result of their better oral vocabulary and decoding ability. In addition, repeated measures ANOVA was also employed to examine the interaction between group and orthographic-phonologic processing.

Between-Group Differences in Accuracy

The descriptive statistics table (Table 2) displays the means and standard deviations of the two groups' performance as well as whether their performance was significantly different. The skilled group outperformed the less-skilled group on all three experimental tasks. In *Nonword Reading*, the skilled group (M = 36.19, SD = 1.92) decoded nonwords better than the less-skilled group (M = 29.15, SD = 6.30). Their performance was significantly different, $F(1, 52) = 30.83$; $p < .001$, suggesting that the skilled learners were better decoders and that the less-skilled learners were comparatively weaker in phonological decoding. In terms of *Word Reading*, the skilled group scored an average of 95.67 (*SD* = 2.43) out of 100 words while the less-skilled group correctly named an average of 60.44 words (*SD* = 12.13). The difference was statistically significant, $F(1, 52) = 219.00$; $p < .001$. It suggests that the skilled learners had in their long-term memory better representations of English words and that the less-skilled learners were weak in oral vocabulary. The skilled group was apparently more homogeneous than the less-skilled group in terms of their decoding ability and phonological representations of English words because the latter had greater standard deviations in both Word and Nonword Reading. In *Rhyme Detection*, the skilled readers (*M* = 48.22, *SD* = 5.94) consistently recognized more pairs of rhymed words than did the less-skilled readers (*M* = 40.59, *SD* = 3.76), and the difference was again statistically different, $F(1, 52) = 31.85$; $p < .001$. To sum up, the skilled group consistently outperformed the less-skilled group in tasks of Nonword Reading, Word Reading, and Rhyme Detection.

Table 2

Descriptive Statistics and Significant Effects for Group Differences in Accuracy of All Measures

	Group					
	Skilled (n = 27)		Less Skilled (n = 27)			
Measure	*M*	*SD*	*M*	*SD*	*F*-value	*Max.*
Nonword Reading	36.19	1.92	29.15	6.30	30.83^{***}	40
Word Reading	95.67	2.43	60.44	12.13	219.00^{***}	100
Rhyme Detection	48.22	5.94	40.59	3.76	31.85^{***}	60
OSPS	15.74	0.59	15.30	1.03	3.77	16
ODPS	12.96	2.08	11.11	2.75	7.78^{**}	14
ODPD	11.96	0.19	11.78	0.42	4.28^{*}	15
OSPD	7.26	4.58	2.41	2.26	24.38^{***}	15

Note. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

As one aim of the study was to probe the interaction between orthography and phonology in the EFL university learners at different proficiency levels, a 2 x 4 (group x orthographic-phonologic processing) repeated measures ANOVA was computed. However, as the Sphericity was violated (Mauchly's W = .134, $df = 5$; $p < .05$), a correction was needed and the Greenhouse-Geisser is reported instead. The result showed the main effect of orthographic-phonologic processing, $F(1.79, 93.05) = 250.70$, $p < .0001$, $\eta p^2 = .83$. In addition, a significant main effect for the interaction of group and orthographic-phonologic processing was also found, $F(1.79, 93.05) = 16.75$, $p < .0001$, $\eta p^2 = .24$. Put together, the results suggest that skilled and less-skilled EFL learners differed significantly in how they accurately processed English words. Further group comparisons on the four combinations in Rhyme Detection were made.

Results show that the two groups had the most significantly different performance on OSPD. The skilled learners ($M = 7.26$, $SD = 4.58$) correctly chose rhymed word pairs more than the less-skilled learners did ($M = 2.41$, $SD = 2.26$), and the difference was highly significant, $F(1, 52) = 24.38$; $p < .001$. Moreover, two skilled learners and seven less-skilled learners scored zero on the OSPD combination.

In addition, similarly significant between-group differences were observed on both ODPS ($M = 12.96$, $SD = 2.08$ vs $M = 11.11$, $SD = 2.75$; $F[1, 52] = 7.78$; $p < .01$) and ODPD ($M = 11.96$, $SD = .19$ vs $M = 11.78$, $SD = .42$; $F(1, 52) = 4.28$; $p < .05$) combinations, where the skilled group performed better than the less-skilled group. The two groups only performed non-differentially on OSPS, $F(1, 52) = 3.77$; $p > .05$. To sum up, group comparisons show that the skilled group indeed had a larger sight word vocabulary and better phonological decoding skills, which culminated and manifested in their better judgment of rhymed pairs.

Between-Group Differences in Reaction Times

The next table (Table 3) displays the mean times the participants of both groups spent responding to the test items of the three experimental tasks. However, the reaction time data in the two naming tasks will be discussed very briefly because the RT data in the two measures might be flawed with confounds.

Table 3

Descriptive Statistics and Significant Effects for Group Differences in Reaction Times of All Measures

Measure	Skilled (*n* = 27) *M*	Skilled (*n* = 27) *SD*	Less Skilled (*n* = 27) *M*	Less Skilled (*n* = 27) *SD*	*F*-value
Nonword Reading	2476.67	512.04	3328.04	986.22	15.85^{***}
Word Reading	1854.14	244.22	2597.72	623.72	33.27^{***}
Rhyme Detection	2908.30	782.76	3382.53	996.88	3.78
Combinations					
OSPS	2284.19	684.61	2749.70	964.66	4.18^{*}
ODPS	3806.38	1338.55	4215.40	1471.77	1.14
ODPD	2197.50	658.28	3068.96	981.18	14.69^{***}
	(*n* = 25)		(*n* = 20)		
OSPD	4302.31	2075.29	5467.50	1570.48	4.32^{*}

Note. $^{*}p < .05$, $^{***}p < .001$.

Quite a different overall result was attained for *Rhyme Detection*. The skilled group (*M* = 2908.30, *SD* = 782.76) was indeed faster than the less-skilled group (*M* = 3382.53, *SD* = 996.88), but the difference was non-significant, $F(1, 52) = 3.78$; $p > .05$. As the repeated measures ANOVA has shown the main effect for the interaction of group and orthographic-phonologic processing, comparisons of the two groups on the four combinations were further made.

It was discovered that the two groups performed comparably only on ODPS, $F(1, 52) = 1.14$; $p > .05$. Among the other combinations, the most significant RT difference occurred on ODPD, $F(1, 52) = 14.69$; $p < .001$, where the skilled group (*M* = 2197.50, *SD* = 658.28) responded significantly faster than the less-skilled group (*M* = 3068.96, *SD* = 981.18). With regard to the OSPS combination, the skilled group (*M* = 2284.19, *SD* = 684.61) had a faster speed than the less-skilled group (*M* = 2749.70, *SD* = 964.66) in making correct decisions, and the difference was significant, $F(1, 52) = 4.18$; $p < .05$. Lastly, 25 skilled learners were compared with 20 less-skilled learners on OSPD. The skilled group (*M* =

4302.31, *SD* = 2075.29) responded faster than did the less-skilled group (*M* = 5467.50, *SD* = 1570.48), and the difference was significant, $F(1, 43) = 4.32$; $p < .05$.

Correlations Among Measures of Nonword Reading, Word Reading, and Rhyme Detection

Pearson's correlations (Table 4) were run to assess the possible associations among measures in the two groups. It was found that Nonword Reading was correlated with Word Reading ($r = .67$, $p < .001$) and Rhyme Detection ($r = .43$, $p < .05$) in the less-skilled group. In the skilled group, Rhyme Detection was associated with Word Reading ($r = .41$, $p < .05$) only. The finding seems to indicate the possibility that decoding ability played an important role when the less-skilled group attempted naming and recognizing words but made little impact to the skilled group on the two tasks. Nevertheless, the finding of a lack of association between Nonword Reading and Word Reading / Rhyme Detection in the skilled group is contradictory to the hypothesis that stronger associations in relation to Nonword Reading would be found in the group. Further discussion and possible reasons will be made to account for the result.

Table 4

Correlations between TOEIC Reading, Word Reading, Nonword Reading, and Rhyme Detection

	1. Reading	2. NWR	3. WR	4. RD
1. Reading	-	.05	.28	.16
2. NWR	.12	-	.10	.13
3. WR	.00	.67***	-	.41*
4. RD	.26	.43*	.27	-

Note. Below the diagonal are Pearson's correlation coefficients (*r*) for the less-skilled group and above the diagonal are for the skilled group. Measure 1 Reading refers to the participants' TOEIC Reading scores, Measure 2 NWR to Nonword Reading, Measure 3 WR to Word Reading, and Measure 4 RD to Rhyme Detection.
$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

DISCUSSION

In an attempt to investigate whether university learners at different reading proficiency levels develop similar or different strategies for English word recognition, two groups of participants who had taken TOEIC were recruited. Rhyme Detection with orthographic and phonological information under manipulation was administered to compare how orthography and phonology interacted in the EFL university learners. It was found that the less-skilled learners were more adversely affected by orthographic information but that the skilled learners were sensitive to the orthography but relied more on phonological information during English word recognition processes. In addition, as word recognition skills are essential to reading English, Nonword Reading was assessed to examine their phonological decoding. Furthermore, Word Reading was administered to assess the participants' phonological representations of the high-frequency words. The results demonstrate that the less-skilled learners indeed had poorer phonological decoding abilities in words and nonwords, which were associated with their orthographic-phonologic processing in Rhyme Detection. The disadvantage in accuracy was extended to reading fluency, i.e. reaction times. The less-skilled learners consistently had a significantly slower speed than did the skilled learners in Rhyme Detection and the two naming tasks. Taken together, the results seem to suggest that the less-skilled learners were less efficient at phonological processing when they read the alphabetic L2, which might be attributed to their over-reliance on orthographic information. In contrast, the skilled learners had significantly stronger word recognition skills and better phonological representations of English words, which might have contributed to their L2 word processing in Rhyme Detection. The results are to be discussed in more detail.

In the present study, the skilled group consistently and significantly outperformed the less-skilled group in both aspects of accuracy and fluency on the two experimental measures of Nonword Reading and Word Reading. Given their reading performance on TOEIC, the results are within expectations. For the skilled learners, their accuracy rate on Nonword Reading was close to the ceiling and their reaction times were similar across correct and incorrect answers at a little more than 2,000 milliseconds. The results suggest that they were confident of their knowledge of grapheme-phoneme correspondence rules and did not hesitate in reading nonwords. It is apparent that they were better aware of alphabetic knowledge and more adept in employing letter-sound knowledge. In other words, the skilled group was more adequately equipped with grapheme-phoneme mapping rules, one of the keys to successful English reading (Lee, 2011). In comparison, the less-skilled group was significantly poorer in their phonological decoding and slower in response by almost 1,000 milliseconds than the skilled group, which suggests that the former group might not have been equipped with alphabetic knowledge sufficiently detailed to allow them to make rapid grapheme-phoneme transfer. In other words, the less-skilled group might have been aware of only partial alphabetic knowledge, which accounted for their less accurate and slower response times on Nonword Reading (Hamada & Koda, 2008).

On the Word Reading task, the two groups performed similarly to how they did on Nonword Reading. Given their performance on Nonword Reading, the skilled group undoubtedly performed better than the less-skilled group (Hu, 2013; Tunmer & Chapman, 2012; Yeung, Siegel, & Chan, 2013) because the quality of phonological representations had an impact on word reading. However, better grapheme-phoneme mappings did not singly account for their better performance on Word Reading because the task goes beyond the skill of mere phonological decoding. When the words were named, the participants had to recognize the orthographic form and associate it with its semantic meaning in their mental lexicon while they simultaneously retrieved the phonological form of a word (Ehri, 2005). If one process failed, they might have difficulty naming a word correctly. On Word Reading, the skilled group had a significantly high accuracy rate, which suggests that they had no difficulty recognizing the words and were able to successfully retrieve their phonological forms. On the other hand, the less-skilled group was poorer on Word Reading, which in turn suggests that they might have a smaller vocabulary and were definitely unfamiliar with their phonological forms. Nevertheless, weakness in L2 word naming seems to be quite prevalent among low-proficiency L2 learners. In Borodkin and Faust's study (2014), the low-proficiency Hebrew-English learners not only mispronounced target words more than the high-proficiency learners did but were also characterized by cognitive weaknesses in phonological processing. The less-skilled learners in the present study showed a similar weakness in phonological processing, which was also observed in other research on Chinese-L1 adult learners (Harrison & Krol, 2007).

When speech is involved in language processing, the rate is certainly slowed down. Consequently, the Rhyme Detection task which involved compulsory word processing but excluded oral production was employed as one measure to tease oral production out of word recognition. The four combinations of orthographic and phonological information were examined separately to probe the interaction between orthography and phonology.

Results show that the less-skilled learners were more adversely affected by orthographic information during the word recognition process. When accuracy of the four combinations was examined, the two groups differed significantly on three combinations except for OSPS where the two groups performed comparably and close to the ceiling. In stark contrast, the most significant between-group difference occurred when the two words looked alike but did not rhyme (i.e., OSPD). As the results from the two combinations were compared, it seems to suggest that the less-skilled learners tended to consider two words were more likely to rhyme when they were orthographically similar. Given their poorer performance in Word Reading where the less-skilled group indeed had poorer phonological representations of English words, it is quite plausible that, more similar to the strategy they employed in reading Chinese characters (Anderson et al., 2013; Li et al., 2002), visual-orthographic skills remained as the major strategy the less-skilled EFL learners relied upon in determining whether two words rhymed when they were not sure of the phonological representations.

The fluency data on OSPS and ODPD provide further evidence that the less-skilled learners had to rely on orthography because they were phonologically inefficient in word recognition (Hamada & Koda, 2008; Wang et al., 2003). On OSPS, even though both groups performed comparably in accuracy, the less-skilled learners reacted significantly much more slowly than did the skilled learners. The gap in processing fluency grew wider and became the most statistically significant on ODPD. Given the fact that the test items were all monosyllabic words throughout the task, the increasingly greater significance value clearly indicates that the less-skilled group needed much more time when processing two orthographically dissimilar words than they did on similar words. As it is quite plausible that the less-skilled participants might have attempted to simultaneously activate the phonological codes upon seeing the orthographic forms, the significant RT difference could be accounted for by their slower processing of the orthography or inefficiency in activation of the phonology. All in all, the fluency data further support the finding that the less-skilled learners were more adversely affected by orthography in single word recognition.

In comparison, the skilled learners relied more on the phonological information in word recognition (Foy & Mann, 2001; Hu & Schuele, 2005). When the orthographic forms were different, both groups seemed to have paid more attention to the phonological information in words because they had closer though still significantly different scores on both ODPS and ODPD combinations. Between the two combinations, the skilled group performed better on ODPS than on ODPD in terms of accuracy and the within-group difference was also statistically significant. This accuracy result is intriguing because when the orthographies of two words are dissimilar, it is expected that their phonological information is more likely to be dissimilar. Discrepancies are thus more likely to happen when the orthographic information is different but the phonological information is similar (ODPS) or the other way around (OSPD). Meanwhile, between the two, the contrast should be stronger on ODPS, i.e., when the two words are dissimilar but rhyme. Nevertheless, the skilled learners scored higher on ODPS than on ODPD. But the high accuracy rate was achieved with a cost of reaction times: The skilled group who consistently had significantly faster reading speeds performed non-differentially from the less-skilled learners in processing ODPS word pairs. The result of non-significant reaction times suggests, on the one hand, that the skilled learners were apparently more affected by the discrepancy and delayed as a consequence in the process of processing the orthographic and phonological information. Despite the delay, they relied more heavily on phonology in word recognition and were able to make more correct decisions, which in turn supports the claim of the skilled group's greater reliance on phonological information in word recognition. On the other hand, the result also suggests that the skilled learners were also very sensitive to the orthographic information in addition to the phonological information. After all, more sophisticated phonemic awareness develops in young learners only after they start to learn the alphabet (Ehri, 2005). As the skilled learners learned more words, they had to represent the words in a more phonologically segmental way so that they could efficiently encode, store, and retrieve phonological information (Metsala & Walley, 1998).

In answer to the last research question, dissimilar correlational relationships between measures have been obtained for the two groups.

In the less-skilled group, their Nonword Reading was significantly associated with Word Reading, in accordance with previous research finding that poor decoders were similarly poor in word reading (Eason et al., 2013). In addition, their decoding ability was also correlated with their performance on the Rhyme Detection task, which was similar to word naming in the aspect that the participants had to activate phonological representations of words. Put together, decoding ability, or orthographic-phonological knowledge, played a very crucial role to the less-skilled learners because they performed better in Word Reading and Rhyme Detection when they had better decoding ability. In other words, they could rely more on phonological information and less on orthographic information if they had more adequate alphabetic knowledge.

In contrast, Rhyme Detection was associated with Word Reading but not with Nonword Reading in the skilled group. In light of their close-to-the-ceiling scores on Nonword Reading, their decoding skills might have become efficiently automatic and made little contribution to reading (Yaghoub-Zadeh et al., 2012). When the skilled group had adequately accurate phonological representations of the words in both Word Reading and Rhyme Detection, their word recognition became so immediate that they did not have to put forth much effort to utilize their decoding ability in either task. In other words, while they managed to recognize the real words fast and accurately, as was demonstrated by their performance in Word Reading and Rhyme Detection, they might not have employed decoding skills in the two tasks. This, in turn, might have accounted for the lack of association between Nonword Reading and the two tasks.

To sum up, the interaction of orthography and phonology in acquisition of L2 literacy could possibly be accounted for by the reading strategies the L2 learners adopted. The skilled learners relied more on phonological information while the less-skilled learners were more adversely affected by orthographic information (Kato, 2009). As Chinese-L1 speakers, the two groups developed different reading strategies and behaved differently in English word recognition. The skilled learners behaved more similarly to English-L1 speakers and developed phonological decoding abilities critical for word and nonword reading. Their adequate word processing strategies could be attributed to well-established decoding skills, which altogether contributed to their performance in both accuracy and fluency on Rhyme Detection. In comparison, the less-skilled learners still relied more heavily on visual-orthographic skills, similar to their L1 reading strategies, and less on phonological information. The reading strategies inappropriate in reading an opaque L2 might have accounted for their underdeveloped decoding ability and poor phonological representations of English words.

Pedagogical Implications

Adequate word processing strategies are crucial to acquisition of a new language. When such strategies in another language are different from those in the learners' L1, the skills required for such strategies should be explicitly taught because the skills might not develop naturally and spontaneously in the L2 learners. In the present study, it is apparent that a majority of less-skilled learners who took the remedial courses were short of efficient orthographic-phonological knowledge and adequate phonological representations of words. Instead of aiming to lift learners' language proficiency, the remedial courses should shift emphasis to promote learners' lower-level processing abilities, such as decoding ability and phonemic awareness, so that the less-skilled learners can become more sensitive to the association between orthography and phonology in alphabetic languages. In addition, systematic instruction in vocabulary should be simultaneously provided so that the learners can employ their decoding ability in a more practical way. Only when the lower-level processing abilities are consolidated will the learners become more skilled in word recognition before they can use vocabulary knowledge to support their reading comprehension.

However, it is also necessary to point out that the less-skilled learners should not be treated as a homogeneous group. As shown in the standard deviation data (Table 2), the less-skilled learners varied greatly in their Nonword and Word Reading. It is perhaps necessary to assess the less-skilled learners individually and separate them into groups based on their linguistic weaknesses before proper intervention is provided. In other words, remedial courses should be designed to accommodate less-skilled learners with different needs. For example, the remedial courses in the beginning stage can be confined to instruction in lower-level processing abilities while higher-level processing abilities, such as syntactic processing, can be taught in the advanced remedial courses. Between the two ends, vocabulary should be systematically instructed so that an increasing number of words can act as building blocks to improve learners' reading skills.

CONCLUSION

Reading difficulties of less-skilled learners are often manifested in inadequate word reading, which is conveniently attributed to poor phonological decoding (Borodkin & Faust, 2014). However, different writing systems require different reading strategies for word recognition to take place, especially when two scripts vary greatly orthographically and phonologically. The inability of some learners to develop efficient phonological skills for L2 reading might be a consequence of improper employment and transfer of their L1 reading strategies (Akamatsu, 2003; Hamada & Koda, 2008; Wang et al., 2003). Meanwhile, in an EFL context, the key to successful English reading is often not explicitly instructed in early stages of learning the new language. When the two writing systems of language learners are incongruent, their phonological processing skills need to be greatly adjusted and modified to accommodate the new L2 script or their acquisition of the new language might be impeded. But decoding ability and phoneme awareness, key factors to successful English literacy acquisition, do not develop spontaneously when children start learning to read an opaque language. Rather, most young learners need to have the grapheme-phoneme correspondence rules clearly pointed out for them to make sense of the alphabetic principle (Foy & Mann, 2001). It is critical for educators and language teachers to review EFL language teaching in a new perspective given the fact that the disadvantage incurred by poorer phonological processing is not limited to young learners but can extend to adult learners.

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APPENDIX

Appendix A. QARI Word Reading

Form A

List A	List B	List C	List D	List E
man	airplane	citizen	contribution	ambitious
so	before	computer	convenient	politician
day	water	information	individual	duration
sun	hundred	temporary	acknowledge	enthusiastic
tree	bank	explanation	pollution	sufficient
friend	Thursday	application	optimistic	economical
her	complete	concentrate	reputation	comprehension
long	package	development	urgent	interruption
us	record	material	prescription	anticipate
when	science	practice	confidential	productivity

Form B

List A	List B	List C	List D	List E
big	Tuesday	actual	description	appreciate
make	window	position	pessimistic	leisure
they	strong	benefit	solution	essential
walk	office	organize	opportunity	modernization
today	amount	employment	reliable	emphasize
play	dollar	management	communicate	strenuous
know	program	occupation	regulation	incompetent
his	success	deposit	involvement	participate
cash	together	intention	accidental	influential
was	common	instruction	indefinite	problematic

Note. Adopted from Chall, Roswell, Curtis, and Strucker (2003)

Appendix B. Nonword Reading

List A	List B	List C	List D
plood	louble	hampent	thickery
chove	hausage	sladding	commeecitate
fongue	soser	bannifer	sepretennial
jint	pettuce	versatrationist	confrantually
hign	skeady	barrason	pennel
wamp	polonel	commerine	trumpetine
cread	narine	doppelate	stopograttic
nowl	kolice	glistering	rubid
sworf	dever	fennerizer	prindle
jase	kiscuit	voltularity	defermication

Note. Selected and adopted from Nonword Reading Test (Snowling, Stackhouse, & Rack, 1986) and the Children's Test of Nonword Repetition (Gathercole, 1995)

Appendix C. Rhyme Detection

List A	List B	List C	List D
last / past	book / noun	dial / mile	harm/ warm
care / hair	doll / toll	lose / nose	reign / train
foul / soul	float / quote	march / brown	barge / large
east / swim	dark / mark	guilt / built	crush / brush
bone / gone	south / youth	bribe / tribe	dress / peach
blot / clot	like / bike	hope / soap	juice / moose
group / clear	right / light	break / freak	horse / worse
loan / tone	jazz / fill	side / what	sound / pound
bait / fate	toad / load	bland / gland	droll / stole
leave / twice	heard / beard	couch / touch	storm / thing
hill / will	flake / break	stuff / tough	tough / bough
move / love	made / fade	file / tile	dream / cream
soft / loft	phone / known	spoke / croak	fare / bear
shoot / fruit	watch / catch	sour / four	grown / crown
hive / give	drive / glass	grape / skirt	roast / grant

Note. Selected and adopted from Kramer and Donchin (1987)

成人英語學習者在單詞認讀策略上之比較：字與音的對比

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本研究藉由測試已參加過多益測驗之大學生的單詞認讀，試圖比較不同程度的成人英語學習者在單詞認讀策略上，是否會有偏重拼字或語音的差異？結果顯示，閱讀能力高者在「非單詞認讀」與「單詞認讀」二項測驗的準確度與反應時間上，皆顯著優於閱讀能力低者；此外，在「押韻辨識」——判斷二個單音節單詞是否押韻的測驗，前者雖在整體準確度上顯著優於後者，但其整體之反應時間卻無明顯差異。然而，在進一步將押韻辨識裡的字詞依照拼字與字音之變數區分後發現：若是該組字詞屬於拼字相似且押韻，這二組受試者在準確性上的表現相當；但是當該組字詞屬於拼字相似但卻不押韻，後者的表現明顯劣於前者；此結果顯示閱讀能力低者明顯在押韻辨識項目上多依賴拼字做決定。相對的，閱讀能力高者在押韻辨識項目的反應皆快於閱讀能力低者，唯有在詞組的拼字不同但押韻的項目上，前者的表現與後者相當；此一結果顯示前者在此一項目上多依賴字音做決定，可能由於拼字雖不同但是字音卻相同的矛盾，造成其反應時間變慢。總述以上數點，閱讀能力低者在語音解碼能力上與英語單詞字音充分不足，這些可能是造成其在單詞認讀策略上過分依賴拼字的原因。

關鍵詞：英語學習者、拼字、語音、單詞認讀、大學生