

# Phonemic Awareness and Reading Comprehension among Japanese Adult Learners of English

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## Abstract

Phonemic awareness (PA) accounts for individual differences in early reading achievement in English as a first language (L1), but its effect generally fades with age. However, in English as a second language (L2), PA may still explain variation in reading ability among the adult population, depending on the readers' L1 background. We examined the role of PA in the reading comprehension of L1-Japanese readers to closely examine the relationship between PA and reading comprehension. A path analysis revealed that PA makes an indirect contribution to reading comprehension through decoding, which along with vocabulary knowledge directly supports reading comprehension. The present study provides evidence for a role, albeit indirect, played by PA in L2-English reading by L1-Japanese adult readers, and thus lends support to the understanding of the importance of fundamental phonological processing in L2 reading.

## Keywords

Phonemic Awareness, Decoding, Reading Comprehension, Second Language Reading, Japanese Adult Learners of English

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## 1. Introduction

Phonemic awareness (PA) enables decoding in alphabetic languages, such as English, by helping readers extract sound information from written input, and is a fundamental ability for reading skills development (e.g., Ball & Blachman, 1991; Ehri et al., 2001; Engen & Høien, 2002; Liberman, Shankweiler, Fischer, & Carter, 1974; Nation & Hulme, 1997). Decoding skills supported by PA foster the accurate pronunciation of unfamiliar words and help readers create phonological representations of unknown words as a means of word inference (Hamada

& Koda, 2010; McCandliss, Beck, Sandak, & Perfetti, 2003). Accordingly, these lower-level phonological processing skills are critical for reading success (Holm & Dodd, 1996; Nassaji, 2014). Although the effect of PA generally weakens with age, once young readers attain a sufficient level of mastery of the phonemic structures of spoken input (Chapman, 2003; de Jong & van der Leij, 2002; Hogan, Catts, & Little, 2005; Scarborough, Ehri, Olson, & Fowler, 1998), PA may continue even after this point to play a supporting role in the interplay among literacy components. This possibility has been explored by Carlson, Jenkins, Li, and Brownell (2013), whose longitudinal study examined the relationships among PA, decoding, vocabulary, and reading comprehension (RC) among 3 - 10-year-old children with disabilities. Their model revealed that PA indirectly contributed to RC through decoding, which along with vocabulary knowledge directly contributed to RC. Carlson et al. thus underscored the importance of PA by showing that even in cases where PA does not have a direct impact on RC it can still support RC through decoding.

The simple view of reading, one of the models used to theorize RC skills, argues that RC necessitates “decoding and linguistic comprehension”; decoding here is phonologically-mediated word recognition, while linguistic comprehension represents lexical access and understanding of what one has heard (Gough, Hoover, & Person, 1994; Hoover & Gough, 1990). Various studies have supported this model by showing that the two components contribute to RC independently in L1 and L2 reading (Braze, Tabor, Shankweiler, & Mencl, 2007; Gottardo & Mueller, 2009; Hoover & Person, 1994; Yaghouh Zadeh et al., 2012; but see Pasquarella, Gottardo, & Grant, 2012). These findings, as well as the aforementioned studies that showed that impairment in PA causes deficits in decoding and RC (Hodd & Dodd, 1996; Manis, Seidenberg, & Doi, 1999), support the notion that PA plays a fundamental role in reading alphabetic languages.

In contrast to the widely acknowledged importance of PA in reading English, there has been a growing awareness that phoneme may not be the universal phonological base unit in reading across different languages (e.g., Pan & Chen, 2005; Perfetti, 2003; Perfetti, Cao, & Booth, 2013). Writing systems vary in terms of the basic linguistic units represented by individual written symbols: alphabetic characters represent phonemes, those in syllabaries, such as Japanese *kana*, represent syllables, and those in logographies, such as Chinese *hànzì* and Japanese *kanji*, represent morphemes. Ziegler and Goswami (2005) states in their psycholinguistic grain size theory that these differences lead to differences in the utilization of phonological units in the reading process, even if involvement of phonology is a universal principle of reading (Perfetti, 2003; Perfetti et al., 2013). In general, it can be said that English readers rely on phonemic information, because of the small grain size of information presented in alphabetic characters, while Chinese readers rely less on phonology and more on holistic visual configuration of orthography (Koda, 2007).

This cross-linguistic difference in cognitive processes during reading has critical implications for readers' acquisition of reading skills in L2, because they transfer the cognitive strategies already established in their L1 to L2 reading (Commissaire, Pasquarella, Chen & Deacon, 2014; Koda, 2005, 2007). An extensive body of L2 word recognition studies has documented the lasting influence of L1 word recognition processes even among advanced-level L2 readers. Of particular relevance to the current study is the finding that L2 readers' use of phonological information may be affected by the orthographic properties of their L1; readers with alphabetic L1 backgrounds draw on phonemic information, whereas those with logographic L1 backgrounds tend to be less capable of using phonemic information and rely more on holistic visual cues (e.g., Akamatsu, 1999; Hamada & Koda, 2008, 2010; Koda, 1990, 1999; but see Wade-Wooley, 1999). A study conducted by Hold and Dodd (1996) assessed PA and decoding among L2-English readers with different alphabetic literacies, namely, Hong-Kong, Mainland China, and Vietnam participants. The Hong-Kong participants had not received alphabetic literacy instruction before learning English, in contrast to the Mainland Chinese participants who were exposed to *pinyin* (an alphabetic phonetic system for learning to read Chinese characters), and the Vietnamese, whose L1 is an alphabetic language. The results showed that Hong-Kong participants performed poorly on PA and nonword decoding, although similar score differences were not found on real-word tasks. Hold and Dodd speculate that the poorer performance of these participants than the others on the nonword task was due to the lack of phonological experience in their first language (L1) processing. Differences in skills to assemble phonology by linking print and sound reflect different reading subskills (Geva & Yaghouh Zadeh, 2006; Holm & Dodd, 1996; Manis et al., 1999). Accordingly, transfer of L1 cognitive processing to L2 reading does not always result in a positive effect; L1 transfer functions positively where the required written input processing is similar between L1 and L2, but negatively where dissimilar (Hamada & Koda, 2010; Holm & Dodd, 1996). This phenomenon also can be explained by the script dependent hypothesis about alphabetic languages (Geva & Siegel,

2000), which suggests that the differences in orthographic complexity between languages require different processing pathways. The L1 transfer of specific orthographic or phonological rules such as word stress and (ir)regularity of letter-sound correspondences represents them as errors in L2 performance, even though required processes (e.g., decoding) are shared between languages (Geva & Siegel, 2000; Wang & Koda, 2005).

These variations observed in the use of phonological information in L2 word recognition points to the importance of clarifying how such variation relates to RC. Only a handful of L2 reading studies to date are pertinent to this question (Nassaji & Geva, 1999; Kato, 2009; Koda, 1998; Hamada & Koda, 2010). For example, Hamada and Koda (2010) reported that the correlation between real-word decoding and RC was significant for an alphabetic L1 group but not for a non-alphabetic L1 group. Most of these studies, however, have looked at the use of phonological information in written input and have not examined PA.

The current study thus targets PA as a possible predictor of L2 RC. To our knowledge, only Koda (1998) has done empirical work on this topic, comparing the relationships among PA, decoding, and RC in proficiency-matched adult learners of English whose native languages were Chinese (a non-alphabetic language) and Korean (an alphabetic language). The Koreans exhibited significant links among the three variables, with around 50% of their RC variance explained by decoding; in contrast, the Chinese did not show any significant correlations among the variables, even though there were no differences in PA, decoding, or RC test scores between the two groups. These findings were interpreted as showing that the Chinese participants had explicit phoneme-manipulation skills but did not utilize them during the reading process, because they relied more on orthographic processing than on phonological processing (see also Ehrlich, Zhang, Mu, & Ehrlich, 2013). Koda (1998) thus suggested that L2-English readers without alphabetic reading experience in their L1 go through a qualitatively different cognitive process from those with an alphabetic L1 background.

Pursuing the same line of research, the current study focuses upon L1-Japanese adult readers of L2-English. The Japanese language has been treated as logographic in previous studies, because it contains logographic *kanji* (e.g., Wade-Wooley, 1999; Koda, 1990; Hamada & Koda, 2010). However, unlike Chinese, Japanese also uses *kana*, a non-alphabetic phono-syllabic writing system. The characteristics of the Japanese language in combination with those of this mixed writing system lead to the prediction that L1-Japanese readers will rely more on phonological processing than do L1-Chinese readers. Mann (1986) found that L1-Japanese children by the age of 10 are able to manipulate phonemes as well as moras (syllable) in phonological awareness tasks in both their L1 and an L2 (English), although they have not received any alphabetic instruction. Moreover, their L1 phonological processing skills significantly contribute to their L1 reading comprehension (Kobayashi, Kato, Haynes, Macaruso, & Hook, 2003). Those studies focusing on Japanese participants indicate that phonological processing plays an important role in their reading process (Akita & Hatano, 1999). However, even though *kana* requires phonological processing, it is still a syllable-level protocol and does not share the same script with English, so the psychological sublexical unit is different from that of English (Ziegler & Goswami, 2005); thus, the cognitive processing executed might have different features (Geva & Siegel, 2000). Given these points, it remains unclear whether L1-Japanese readers make use of phonological processing skills at the phoneme level when reading in English. Thus, it is of interest whether PA will make a contribution to RC in English among an L1-Japanese adult population.

This study takes up the following research question: Does PA have any effect on L2-English RC among L1-Japanese adult readers? We examined this question by including vocabulary knowledge as well as decoding as variables, because these two are known influential predictors of RC and may mediate between PA and RC (August & Shanahan, 2006; Braze et al., 2007; Carlson et al., 2013; Engen & Høien, 2002; McCandliss et al., 2003; Pasquarella et al., 2012).

## 2. Method

### 2.1. Participants

A total of 57 undergraduate and 14 graduate students learning English as a foreign language participated in the present study (male: 37; female: 34; aged 18 - 24 with a mode of 19). Their academic backgrounds varied (e.g., education, engineering, informatics science). Of the undergraduates, the majority ( $n = 37$ ) were in their first year, followed by their second ( $n = 16$ ), third ( $n = 1$ ), and fourth ( $n = 3$ ) years. Of the graduate students, all were in their first year of their master's program. All were native speakers of Japanese who had studied English for at least six years in the Japanese formal education system. Of 71 participants, 4 had had the experience of living

abroad for more than a year.

## 2.2. Measures

### 1) PA test

Six PA measures were used: *blending*, *counting*, *deletion*, *isolation*, *oddity*, and *segmentation*. All auditory stimuli were recorded by two native speakers of English and presented on programs developed using Superlab 4.5.

For the blending task, Goldstein's (1974) and Stahl and Murray's (1994) items, one-syllabic English words consisting of two to four phonemes each (e.g., *gun*, *step*, *last*)—27 in total—were used to assess blending ability.

For the counting task, 65 items were adopted from Liberman et al. (1974) and Tunmer and Nesdale (1982); they consisted of one to four phonemes, some of which were English words and some pseudo-words (e.g., /u/, *book*, /niz/). Participants judged the number of sounds in an utterance and pressed the corresponding button on a numeric keyboard on a laptop computer.

Items in the deletion task, adapted from Bruce (1964) and Rosner (1975), were 50 one- or two-syllable English words of three to five phonemes each (e.g., *stop* [remove the /s/], *frog* [remove the /r/], *please* [remove the /z/]). The position of the phoneme to be deleted was at either the beginning, the middle, or the end of the word (words were divided into three equal groups in this regard).

The isolation task (Caravolas, Hulme, & Snowling, 2001; Hulme, Caravolas, Málkováb, & Brigstocke, 2005) required participants to identify either the first or the last sound of pseudo-word stimuli consisting of two to four phonemes, 31 items in total (e.g., /swip/ [say the first sound], /dɒm/ [say the first sound], /bæst/ [say the last sound]).

We used Fernandez-Fein and Baker's (1997) and Nation and Hulme's (1997) items for the oddity task, which was accordingly divided into two parts. The former task consisted of 10 items asking participants to judge which pairs of words started with the same sound (e.g., *pin-pig* and *pin-tree*), while the latter task consisted of 12 items required them to detect which word out of four started with a different sound (e.g., *top-tin-tell-gas*). A half-second intra-pair and a one-second inter-pair pause, in the former task, and a half-second pause between the stimuli, in the latter, were used.

Last, in the segmentation task (Nation & Hulme, 1997; Yopp, 1988), 34 words or pseudo-words between two and six phonemes were presented aurally to the participants, who were asked to respond by saying the word in isolation at the phoneme level (e.g., *three*, /spɪd/, /plʌn/).

Each PA task included instructions written in Japanese and spoken (prerecorded) in English, with the same content. A brief practice session was provided before each test to make sure that participants understood the testing procedures. Items were presented via earphones, and the order of the tests and the items within each test was randomized across participants. Each participant's score consisted of their number of correct responses, with one point awarded per item. In scoring, inter-rater reliability was established by using two independent raters and checking the correlation between results for 10% of the total responses were rated. The reliability was  $r = .80$ . Items that the two raters scored differently were re-scored.

### 2) Vocabulary test

We employed the Vocabulary Levels Test (Nation, 1983), which uses a multiple-choice definition-selection format. There are three target words and six candidate definitions listed in each question; testees chose a definition for each target word. Based on a pilot study, 27 items (nine sets of questions) were used. The level ranges for the selected item sets are as follows: one each from the 2000 and Academic Vocabulary levels, four from the 3000 level, and three from the 5000 level.

### 3) Decoding test

Both real-words and pseudo-words were used to measure decoding ability. Items were adopted from the Word Attack subsection of the Woodcock Reading Mastery Test (Woodcock, 1973) for pseudo-word reading and the Test of Word Reading Efficiency (Torgesen, Wagner, & Rashotte, 1999) for real-word reading. In the pseudo-word reading task, 34 stimuli were shown on a computer screen after a fixation sign (+) for 500 ms. Participants were required to read each word aloud as accurately as possible. Read items were not scored as correct unless a response was elicited within 10 s. One point was added if they had read a word correctly, irrespective of their reading latency.

Real-word reading was composed of two subtests (A and B) in order to obtain a within-person correlation for reliability, with 104 word items in each test. On both tests, participants were asked to read as many words as quickly and accurately as they could within 45 s and were scored according to the number of words they correctly read.

#### 4) Reading comprehension test

Five expository passages with 18 multiple-choice comprehension questions (3 - 10 questions in a passage) were selected from reading sections on samples of the Test of English for International Communication ([Educational Testing service \[ETS\], 2006](#)) and Test of English as a Foreign Language (ETS, n.d.). Text length ranged from 71 to 350 words ( $M = 200$ ), and the average Flesch-Kincaid grade level of the passages was 10.

### 2.3. Procedure

Written informed consent was obtained from each of the participants. PA and decoding tasks were administered individually, while RC and vocabulary tasks were administered either individually or in small groups of up to four. No time limit was set for any test except the real-word reading task. It took around two-and-a-half hours to complete all the tasks.

### 3. Results

For data screening, we first eliminated four students who did not complete all tests and outliers (two SDs away from mean scores). A square root transformation was applied to all data to meet the assumption of normality, as deletion, isolation, segmentation, and oddity for PA and pseudo-word reading task data were negatively skewed. A composite score from the two tests were obtained for each PA measure (blending, counting, deletion, isolation, oddity, and segmentation).

**Table 1** displays the descriptive analysis. Overall, the PA tests were 84% correct. Isolation and oddity tests reached the ceiling, so they were excluded from further analysis. Correlations among the remaining four PA tests are shown in **Table 2**. These four scores were submitted to a principal component analysis in order to examine whether some of the tasks involved or required different processes from the others ([Yopp, 1988](#)). We obtained only one composite score, which explained 52% of variance, and so regarded the tasks as a unified construct and thereafter as a representation of PA. **Table 3** displays the intercorrelations among the dependent and independent variables. Since real-word reading did not significantly correlate with any of these variables, it was not included in our path model.

On the basis of previous research findings, we hypothesized that 1) PA is an indirect predictor of RC via pseudo-word reading ([August & Shanahan, 2006](#); [Ehri et al., 2001](#); [Engen & Høien, 2002](#)); 2) pseudo-word reading and vocabulary are direct predictors of RC ([Carlson et al., 2013](#)); and 3) pseudo-word reading is a predictor of vocabulary ([Braze et al., 2007](#); [McCandliss et al., 2003](#)). With these predictions, we constructed a path model, seen in **Figure 1**. Full-information maximum likelihood was employed to use as much of the observed data as possible.

**Table 1.** Descriptive analysis for PA, decoding, vocabulary, and RC tasks.

Task (the number of item analyzed)	M(SD)	Score range	$\alpha$	Correct percentage of the task	
PA	Blending (18)	12.17(2.47)	7 - 18	.65	73
	Counting (65)	50.44(6.90)	35 - 60	.85	78
	Deletion (46)	30.53(3.63)	30 - 45	.81	85
	Isolation (18)	16.60(1.57)	10 - 18	.63	92
	Oddity (13)	12.84(0.47)	11 - 13	.71	99
	Segmentation (33)	24.85(3.96)	15 - 31	.80	75
Decoding	Pseudo-word (29)	24.07(2.88)	15 - 29	.63	83
	Real-word (208)	123.91(14.85)	92 - 155	.87	59
Vocabulary (22)	19.17(2.16)	7 - 18	.78	87	
RC (18)	14.18(2.40)	8 - 18	.76	79	

Note. The reliability of "Real-word" under "Decoding" is obtained by  $r$ . "RC" represents reading comprehension.



**Table 2.** Intercorrelations within PA Variables.

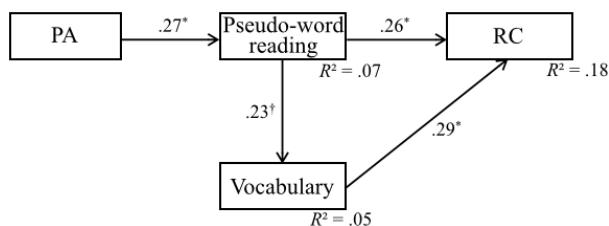
Test	1	2	3
1) Blending	-		
2) Counting	.23 <sup>†</sup>	-	
3) Deletion	.41**	.48**	-
4) Segementation	.17	.48**	.60**

Note. <sup>†</sup> $p < .06$ , \* $p < .05$ , \*\* $p < .01$ .

**Table 3.** Intercorrelations among PA, decoding, vocabulary, RC tests.

Variable	1	2	3	4
1) PA	-			
2) Pseudo-word reading	.26*	-		
3) Real-word reading	.03	-.01	-	
4) Vocabulary	.05	-.09	.23 <sup>†</sup>	-
5) RC	.03	-.01	.33**	.33**

Note. "RC" represents reading comprehension. <sup>†</sup> $p < .06$ , \* $p < .05$ , \*\* $p < .01$ .



**Figure 1.** A bottom-up based reading comprehension model for adult learners of English, showing the standardized regression coefficients. Due to the non-significant correlation between PA and vocabulary ( $r = .05$ ), no arrow was drawn.  $n = 67$ ,  $\chi^2 = .33$ ,  $df = 2$ ,  $p = .85$  ( $p > .05$ ).  $CMIN = 0.16$ .  $AIC = 24.33$ .  $CFI = 1.00$ .  $IFI = 1.09$ .  $NFI = 0.98$ .  $RFI = 0.92$ .  $RMSEA = .00$  ( $p > .05$ ).  $TLI = 1.80$ . <sup>†</sup> $p < .06$ , \* $p < .05$ .

The model showed a reasonably good fit. Both pseudo-word reading and vocabulary significantly contributed to RC, jointly accounting for 18% of its variance. PA significantly contributed to pseudo-word reading, accounting for 7% of variance in it ( $\beta = .27$ ,  $p = .003$ ). Thus, PA made an indirect contribution to RC, through pseudo-word reading. In addition, pseudo-word reading was a marginal contributor to vocabulary, accounting for 5% of its variance ( $\beta = .23$ ,  $p = .058$ ).

### 4. Discussion

The purpose of this study was to see whether PA has any effect on RC in L2-English reading by adult Japanese learners. Although the findings are only tentative due to the small sample size, our path analysis indicated that PA indirectly supports RC through pseudo-word reading. This chain of causal links implies that Japanese learners of English seem to benefit at least to some extent from PA in the English RC process. This is the first L2 reading study that has identified an indirect effect of PA on L2-English RC by adult readers with a non-alphabetic L1 background.

Furthermore, this result offers an interesting contrast to Koda's (1998) findings, where for the Korean (alphabetic) group, both PA and decoding correlated with RC but only decoding made a direct contribution to RC, while for the Chinese (logographic) group, neither PA nor decoding correlated with RC and accordingly neither explained the variance in RC for this group. It seems that the current finding from L1-Japanese participants place them in between Koda's Chinese and Korean groups. That is, PA did not correlate with RC, but did significantly correlate with and contribute to decoding, and thus, PA made an indirect contribution to RC.

Offering definite reasons for this contrast among L2-English readers who are L1 speakers of three Asian languages with different writing systems is beyond the scope of this study, but the mixed character of Japanese writing, which uses both logographic *kanji* and syllabic *kana*, may provide a clue toward the explanation of this

finding. As discussed earlier, L2 word recognition studies have repetitively shown that L2-English readers with logographic L1 backgrounds (Chinese and Japanese) tend to process English words more holistically than do native speakers of English or L2 readers with alphabetic L1s (Akamatsu, 1999; Wang, Koda, & Perfetti, 2003). In other words, L2-English readers with logographic L1s are weak in terms of their ability to utilize phonological information extracted by grapheme-phoneme correspondences rules. However, the results of the current study suggest that, when compared with those of Koda's (1998) Chinese group, L1-Japanese and L1-Chinese readers may utilize phonological information differently from one another in their English reading. However, the present study did not contrast Japanese and Chinese readers; thus, this remains a question for future research.

Another point to be mentioned through the present study is that very few English L2 studies address PA in adults' reading process. This might be because L2 researchers believe to some degree that PA explains very little of the individual differences in RC, a situation suggested by English L1 studies (de Jong & van der Leij, 2002; Hogan, Catts, & Little, 2005; Scarborough, Ehri, Olson, & Fowler, 1998). However, our results suggest that we should not ignore the importance of PA in English reading by L1-Japanese adult learners, even if they learn English as a foreign language and with limited auditory English input, and even if their L1 does not share a script and sublexical unit with English. If future researchers conduct similar studies among EFL adult learners with alphabetic experience in L1s such as Korean or Thai, a clearer answer might be obtained. Additionally, it would be worth clarifying the factors that do or do not cause qualitatively different processing pathways in L2-English reading, by examining, for example, the interplay of learner properties such as ages and language properties such as writing systems within a particular L2 group and/or across the groups (Geva & Siegel, 2000).

Finally, in our data, real-word reading did not correlate with any other variable. One possible reason is related to the methodology of the present study. As Yaghoub Zadeh et al. (2012), obtaining a similar result, point out, a different result would have been observed, had they (or we) employed a reading fluency measure evaluating meaning as well or a timed measure for the RC test. The real-word reading task did not assess participants' vocabulary knowledge, as it was an accuracy and speed task, and the RC test was not conducted under timed condition (Yaghoub Zadeh et al., 2012). Some other past studies among L1-Japanese learners of English have reported similar results. Shiotsu (2009) compared skilled and less skilled readers in non-word recognition speed, lexical semantic access speed, number matching, and real-word recognition speed. Despite the advantage held by the more skilled group, they were not faster than the less skilled group in real-word reading. Additionally, in Yamashita (2013), "sight word reading" (i.e., real-word reading) did not exhibit a significant correlation with RC, in contrast to pseudo-word reading, which did. It seems, then, in conjunction with the present findings, that the ability to use grapheme-phoneme correspondences rules contributes more to RC than does the ability to read real words quickly.

To conclude, the link from PA to RC suggests that PA serves as a basis for L2-English reading among an L1-Japanese population. Finding an indirect effect of PA on RC indicates that phonological processing skills will help these readers process and comprehend written text information in their L2.

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