Language Learning 49:3, September 1999, pp. 447–471

First Language Influences on Second Language Word Reading: All Roads Lead to Rome

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This article reports an experiment investigating similarities and differences in basic processing involved in the word reading of second language (L2) readers of English. The investigation specifically targeted phonological and orthographic processes in the context of language transfer from native language (L1) to L2 during reading tasks. Groups of young adults who were native speakers of either Russian or Japanese and low-intermediate ESL learners were matched on a measure of English word reading and then compared on a number of cognitive and linguistic reading-related tasks. Despite differences in processing strengths, neither group demonstrated an advantage in nonword reading. The results have implications for theories of reading disability built around the notion of deficits in phonological processing.

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This article was written while the author was a postdoctoral fellow supported by the Social Sciences & Humanities Research Council of Canada. The research reported herein was part of the author's doctoral dissertation, and an earlier version of this article was presented at the 1997 annual meeting of the American Educational Research Association in Chicago, IL. The author thanks Josef Shimron, David Share, and Faina Furman at the University of Haifa for their assistance.

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As classrooms worldwide continue to become more linguistically diverse, educators and researchers maintain a focus on effective reading instruction in second language (L2). While the theoretical models of the reading process in L2 are greatly informed by our understanding of the basic cognitive and linguistic processes involved in first language (L1) reading, there are dimensions to reading in a second language that are unique. Koda (1994) identified three conditions that distinguish L2 from L1 reading: (a) the influence of prior literacy, (b) limited linguistic knowledge, and (c) crosslinguistic effects. In this article, we investigate the latter dimension of L2 reading, specifically, the orthographic and phonological effects from first language on the word reading of second language learners. The theoretical importance of this perspective is dual. First, an enhanced understanding of basic processes in L2 will contribute to the building of a model of L2 reading that can stand independent of assumptions based on L1 models. Second, testing assumptions about processes underlying normal reading and reading failure in L1 on an L2 population may also have implications for model building in L1.

Central to an understanding of L2 reading is the investigation of orthographic processing. Often, L2 learners are learning to read in an orthography that is different from the one used in the L1. Because orthographies differ with respect to the basic representational unit, the information and strategies most useful in processing the L1 orthography may be less so in the L2 orthography. Given that fast and accurate word recognition is essential to successful reading comprehension, one may hypothesize that the nature of the L1 orthography influences the way L2 learners attend to the L2 orthographic units. The present study investigates readers of two different L1 orthographies and the use of L1-specific strategies in L2 word reading.

The phonological and orthographic systems of Russian are similar to English on a number of key dimensions. Specifically, Russian has a syllable structure similar to English, which allows consonant clusters in both syllable onsets (e.g., *street*) and codas (e.g., *depth*). In addition, written Russian is alphabetic; as in

English, the basic graphemic unit corresponds to a phoneme. Research reports about word recognition in Russian are difficult to come by; however, Lukatela and Turvey (1998) have demonstrated through a variety of experimental paradigms that the dual orthography (Roman and Cyrillic) of Serbo-Croatian is recognized primarily through the application of grapheme-phoneme computations. Support that this is a feature of alphabets generally has come from languages such as Hebrew (Frost, 1994), Dutch (Bosman & de Groot, 1996), and Spanish (Sebastien-Galles, 1991).

The Japanese writing system employs two scripts: a syllabary (kana) and a logography (kanji). Because kanji have no analyzable phonological segments, it has typically been assumed that lexical access when naming kanji occurs from print directly to meaning, and that the phonological representation of the word is accessible only via semantic mediation. There is experimental evidence consistent with this view (e.g., Feldman & Turvey, 1980; Kimura, 1984; Shimamura, 1987). In a series of studies on Chinese character recognition, Perfetti and his colleagues (Perfetti & Zhang, 1991; Perfetti, Zhang, & Berent, 1992) contended that phonological processing is obligatory in the course of word recognition, but that the nature of the orthography determines the point during lexical access in which phonology is activated. For logographies, Perfetti believes that word recognition is not mediated by phonology, as is the case in English and other alphabets, but is a component of word recognition.

Because kanji are not decomposable, it has been hypothesized that Japanese speakers would experience difficulty at experimental tasks requiring analysis of alphabetic strings. Several studies on bilingual word recognition (e.g., Akamatsu, in press; Brown & Haynes, 1985; Koda, 1988, 1990) have confirmed that L2 readers with a nonalphabetic orthography in their L1 (e.g., Chinese, Japanese) are less efficient at processing the phoneme-grapheme correspondences in English words than are those with an alphabetic L1 orthography (e.g., Persian, Spanish). Brown and Haynes (1985) showed that Japanese speakers were faster than Spanish and Arabic speakers at making same-different judgments

about pairs of English words, but that they were the slowest group at integrating the sound-symbol information necessary for naming. Similarly, in a study using the same languages groups as the Brown and Haynes (1985) study, Koda (1988) presented a phonological task in which participants were asked to identify which of two pseudowords was homophonic with a real English word (e.g., *thare, theer*), and an orthographic task in which they were asked to determine which of two homophonic items was the correct spelling of an English word (e.g., *room, rume*). She found that the Japanese were more severly impaired by the absence of orthographic information in the phonological task than were the participants from the alphabetic groups. In a study of highly fluent English as a Second Language (ESL) speakers, Akamatsu (in press) showed that Chinese and Japanese speakers (nonalphabetic L1) were significantly slower than Persian speakers (alphabetic L1) at naming English words that were presented in alternated case, thereby disrupting holistic word shape information and requiring the participant to process the sequence of letters individually. These studies suggest that language-specific processing parameters may be set in the process of L1 literacy acquisition, and that, depending on the degree of similarity between L1 and L2 orthographies, even highly fluent L2 speakers may continue to employ less-than-optimal underlying strategies in the process of L2 word recognition.

First language effects on phonological processing in L2 reading, on the other hand, have received very little attention in L2 reading research. This is regrettable, because research evidence consistently supports the notion that phonological processing, particularly in the area of phonemic awareness, is directly related to the onset of literacy acquisition in young native speakers of various languages. In fluent readers, phonological processing supports visual and semantic processing of unfamiliar words (e.g., Doctor & Coltheart, 1980) and facilitates the storage of information in working memory (Gathercole & Baddeley, 1993). There is also evidence that phonological processing is impaired in individuals with reading disabilities. Not only do dyslexic children exhibit

markedly poor performance on phonemic awareness tasks (e.g., Bryant, MacLean, & Bradley, 1990), but these deficits in phonological processing continue to be associated with reading difficulty in adolescents and adults (e.g., Bruck, 1990; Pennington, Van Orden, Smith, Dreen, & Haith, 1990).

Although the investigation of L2 phonological processing in word recognition is important for the sake of building a theory of L2 reading, evidence resulting from this perspective also has implications for theories of L1 reading disability. Recently, investigators have begun considering that subtle yet pervasive speech perception deficits underlie the poor phonological processing ability of reading-disabled individuals (for review, see McBride-Chang, 1995). Reading-disabled children have been seen to do poorly at speech perception tasks such as pseudoword repetition (Snowling, Goulandris, Bowlby, & Howell, 1986), identification and processing of stop consonants (Godfrey, Syrdal-Lasky, Millay, & Knox, 1981; Reed, 1989), and repeating stimuli in noise (Brady, Shankweiler, & Mann, 1983). Evidence also suggests that reading-disabled children exhibit a higher degree of noncategorical perception (Metsala, 1997). Fowler (1991) pointed out that poor quality or variable phonological representations that are constructed during speech perception form an inadequate foundation upon which are performed phonemic awareness operations and phoneme-grapheme computations. If reading-disabled individuals are less successful at generating explicitly phonemic representations, then they are also likely to be less successful at assigning phonological representations to new words or reconstructing the original phonological input.

Second language speakers might constitute an interesting population from which to test the hypothesis that poor phonological representations underlie reading difficulties. From studies of speech perception in L2, we know that the phonological system of the native language constrains the L2 learner's ability to perceive and produce the sounds of the target language. Perception of speech is to some degree a language-specific process, and to varying degrees over the course of L2 acquisition learners tend to

perceive and produce the sounds of the L2 in terms of the categories and structures that are relevant in the native language (L1). For example, Werker and Tees (1984) showed that English native speakers cannot differentiate the retroflex and dental stops of Hindi because this contrast is missing in English. Likewise, native speakers of Japanese have difficulty perceiving the /r/-/l/ contrast of English (Goto, 1971; Yamada & Tohkura, 1992). Language-specific processing is not restricted to segmental phenomena; the roles played by stress and syllable structure in language processing also differ among languages and differentially affect L2 learners. English is a language in which stress plays a large role in disambiguation and segmentation of continuous speech (Cutler & Butterfield, 1992), but speakers of languages in which stress is less important may find it difficult to utilize this information as effectively as do native speakers, and so they may use other strategies instead. In French, where the syllable is more salient than in English, native speakers attend to syllables to segment continuous speech, not only in French, but also in English (Cutler, Mehler, Norris, & Segui, 1986). Similar processing phenomena occur in Japanese, where the mora is the basic unit of processing; Japanese speakers apply a moraic segmentation strategy to continuous input in any language, regardless of whether it is an appropriate strategy for ensuring accurate parsing (Cutler & Otake, 1994; Otake, Hatano, Cutler, & Mehler, 1993).

As an explanation of these and similar phenomena, Aslin and Pisoni (1980) suggested that individuals are "attuned" in early childhood to the categories and syllable structure constraints of their native language and therefore process L2 information in terms of these initially specified categories. Age-of-learning effects in second language have suggested to some researchers that fluent L2 phonology can be achieved only if acquired before some critical period (Lenneberg, 1967), although this perspective is not without controversy (Flege, 1987; Long, 1990). Ample evidence exists to show that L2 learners operate with inadequate phonological representations or strategies when they are learning their second language, and depending on their age of acquisition, their

competence in their L2 sound system may never achieve nativelike levels. In previous research, we showed that children in Grade 2 who are non-native speakers of English are significantly poorer than native English speakers at various phonological tasks requiring accurate perception and manipulation of English sounds, yet they are equal to their L1 peers at word reading, decoding, and spelling (Wade-Woolley & Siegel, 1997). In the current study, the participants were young adults learning English as an L2 who had never been exposed to sustained, authentic phonological input from native speakers of English, and the native language groups were chosen as a function of their phonological similarity to (Russian) or difference from (Japanese) English. In this way, the attempt was made to assemble groups that would have greater or less difficulty with the phonological processing required in their L2. In this study, the hypothesis was investigated that Japanese speakers of English would be more at risk than Russian speakers for inadequate phonological representations that may affect word decoding.

Because the independent variable is language group rather than reading ability, as is the case in traditional reading level match designs, there are no a priori differences to explain. Two ESL groups were matched on English word recognition and compared on the basis of a variety of reading-related measures to ascertain the nature of some of the differences between the groups in terms of similarities and differences of underlying processing. The null hypothesis is that the groups will perform equally on other reading, cognitive, and metalinguistic measures, as well as word reading, which is the matching variable. At the same time, however, this comparison may have some relevance to theories of reading disability. Current conceptualizations of reading disability take as an assumption a deficit in the area of phonological representation that percolates into the processing of written language. Because of this, there is no principled reason to rule out the hypothesis that a group of L2 learners who are more at risk for faulty representations than another group of L2 learners may show processing patterns similar to those typically evidenced by

disabled readers. The connection between second language and reading disability in this article is speculative. The primary goal of this study is a clarification of differences in basic processing between two groups with different L1 orthographies and phonological inventories, but a subsidiary objective is an examination of the Japanese and Russian profiles with an eye to analogy with reading disability and normal achievement through the elucidation of the similarities and differences between the need for phonological processing in reading in L1 and L2. Taking this perspective on the data is also intended to clarify some of the theoretical issues behind the notion that speech perception and representational factors are related to reading disability. As it stands, the theory can exclude second language learners only through stipulation; because L2 learners may be subject to the same kinds of deficits in phonological representations as poor readers—such as noncategorical representation of phonemes and syllabic instead of segmental representation—one might, in theory, expect L2 learners to exhibit the same kind of reading-related behavior. By examining this population, we therefore uncover data of interest to theories of reading disability as well as to an understanding of crosslinguistic processing.

Method

Participants

Participants consisted of two ESL groups (composed initially of 18 native speakers of Russian and 21 native speakers of Japanese). The selection criterion imposed on potential ESL participants was that they had never before studied in or visited a predominantly English-speaking country.

The Japanese participants comprised 8 males and 13 females (mean age 21.9 years, range 19–29 years). Their participation was solicited through the ESL program at the continuing studies department of the University of Toronto, which made announcements

to low-intermediate classes. Data were collected from Japanese participants at the beginning of the academic term. Participants' mean length of stay in Canada at the time of testing was 3 weeks. Japanese participants reported a mean of 8.5 years of formal study of English, beginning at a mean age of 12.3 years.

The Russian participants were 8 males and 10 females (mean age 22.5 years, range 20–26 years) who responded to advertisements at the University of Haifa in Israel. The advertisements were directed to students in the Pre-Academic unit, a department for students who, by virtue of their performance on university entrance examinations, were deemed to have remedial needs in Hebrew or English. Participants had all emigrated to Israel from Russia, and their mean length of stay in Israel at the time of testing was 3.9 years. Russian participants reported a mean of 9.4 years of formal study of English, beginning at a mean age of 9.9 years.

Sixteen participants from each language group completed all of the tasks and were included in the reading level match reported here.

Tasks

Participants were administered a number of standardized and experimental tasks. Because most of the standardized tests used in this study were normed on native speakers of English, the scores reported here are raw scores only and no normative references are made with regard to them. On every task requiring an oral response in both the standardized and experimental battery, the respondents' answers were recorded on audiotape and analyzed by two native speakers of English to arrive at consistent scoring. Seven tasks, detailed below, were used.

Test of English as a Foreign Language (TOEFL). To ascertain a gross measure of L2 competence, the reading comprehension and vocabulary subtests of a retired version of the TOEFL (Educational Testing Service, 1991) were administered to all participants. Participants completed the TOEFL subtests and the

experimental tasks in two testing sessions on different days. The score range for both subtests is 0–30.

Woodcock Reading Mastery Test (WRMT)—Word reading subtest. This is a test of recognition of isolated words suitable for an age range from Grade 1 to "average adult." The administration directions state that the participants are assumed to not know the meanings of the words they read. Responses were scored correct if they were produced within 5 s, and allowances were made for "foreign accent." In other words, a response for *vehicle* with initial /w/ instead of /v/ made by a Russian speaker was considered correct. Participants were presented with a series of cards on which the 106 items were printed; testing was discontinued after six consecutive failures.

The 16 participants from each language group who had completed all tasks were matched on raw score on the word reading subtest of the WRMT (Woodcock, 1987). Where possible, participants were matched on identical scores; in three cases, however, a range of 1–3 points in the difference was judged acceptable in order to achieve as large a sample as possible. In these three cases, the point differential favored the Japanese twice and the Russians once.

Woodcock Reading Mastery Test—Word attack subtest. This is a test of participants' ability to apply structural analysis of words and phonics strategies to pronounce words for which they have no sight vocabulary. The 44 items range from simple, regular monosyllables at the beginning to polysyllabic items of increasing difficulty. Items were scored correct if a natural reading was produced within 5 s. Testing was discontinued after six consecutive failures.

Peabody Individual Achievement Test (PIAT; Markwardt, 1989)—Spelling recognition subtest. On this task, participants are presented with a series of cards on which are printed four visually and phonologically similar items, only one of which is a correctly spelled word. The experimenter pronounces a word aloud and the participant is required to point to the item matching that

word. Testing was discontinued after five incorrect responses out of seven.

Orthographic knowledge. This task investigated the participants' awareness of permissible orthographic structures in English. The stimuli were 18 visually similar pronounceable pseudowords (e.g., *filv -filk*) from Siegel, Share, and Geva (1995). In this task, respondents saw pairs of pseudowords appear on a computer screen and were required to push a key indicating which one appeared more "like it *could be* a real word in English." The need for speed and accuracy was emphasized, and the measures taken included errors and response latency. Response times were calculated on correct responses only.

Pseudoword repetition. This task, modelled after that used by Gathercole, Willis, Emslie, and Baddeley (1992) and also Service (1992) to predict vocabulary growth in L2, was designed to tap working memory. Twenty-five pseudowords ranging in length from one to five syllables were presented on audiotape to each participant. The items were designed to contain no phoneme or syllable structure that was absent in the participants' L1. After hearing each item, the respondent was required to repeat it verbatim and the responses were recorded as correct or incorrect by the experimenter.

Phoneme deletion. This task tapped the participants' sensitivity to sublexical phonological structure and their ability to perform metalinguistic operations on sound material. In this task, participants attended to auditorily presented monosyllabic pseudowords and were asked by the experimenter first to repeat the pseudoword (e.g., "say *smeck*") and then to delete a target phoneme (e.g., "now say it without /s/"). The target phoneme was always a consonant and appeared in either the syllable onset or coda. A total of 30 stimuli were presented and response accuracy was recorded.

Results

The mean scores and standard deviations from the L2 participants' performance on the TOEFL appear in Table 1. The TOEFL subtest scores were submitted to repeated measures ANOVA and no differences were found between groups on either the vocabulary section, $F(1, 29) = 1.24$, *ns*, or the reading comprehension section, $F(1, 29) = .75$, *ns*.

Also summarized in Table 1 is the performance of the Russian and Japanese respondents on the dependent measures. Matching the groups on the word recognition led to identical group means. The results show that the groups were also equal in their ability to assign phonological representations to nonwords in pseudoword decoding, $t(1, 31) = 1.23$, *ns*. Likewise, there was no difference between groups on their working memory capacity as measured by the pseudoword repetition task, $t(1, 31) = .54$, *ns*.

Between-group differences appeared, however, on those tasks weighted more toward specific phonological or orthographic processing skills. Japanese participants were faster and more accurate than Russians on the tasks requiring an awareness of legitimate orthographic patterns, whether these appeared in real words on the spelling recognition measure, $t(1, 31) = -3.12$, $p < .01$, or in pseudowords on the orthographic choice measure, $t(1, 31) = -2.25$, $p < .05$. Table 2 shows that both of these tasks were significantly correlated with pseudoword decoding for the Japanese group. The quicker response time for the Japanese on the orthographic choice indicates that they were also faster than the Russians at accessing this knowledge, $t(1, 31) = 3.64$, $p < .01$. In this measure, both orthographic and phonological input confirm the correct response to the question, "Which one seems more like it could be a word in English?" Japanese appeared to have been more able to utilize the dual information to make a faster and more accurate response.

The Russian group, on the other hand, was significantly more accurate at deleting specified phonemes than were their Japanese

Table 1

Group Means and Standard Deviations (in Parentheses) for All Variables

	First language	
	Russian $n = 16$	Japanese $n = 16$
TOEFL vocabulary (range = 0–30)	14.61 (4.27)	16.10 (4.05)
TOEFL reading comprehension (range = 0–30)	13.89 (6.06)	15.76 (7.25)
Word recognition raw score (range = 0–106)	78.81 (3.76)	78.81 (3.83)
Pseudoword decoding raw score (range = 0–45)	34.44 (2.45)	33.43 (2.16)
Phoneme deletion (percentage correct)	91.58 (6.31)	75.09 (18.50)
Orthographic choice (percentage correct)	77.21 (8.28)	83.09 (6.39)
Orthographic choice response time (ms)	2,962 (1,082)	1,859 (541)
Spelling recognition (percentage correct)	67.50 (11.41)	78.31 (7.87)
Pseudoword repetition (percentage correct)	82.00 (11.00)	80.00 (11.00)

counterparts, $t(1, 31) = 3.37$, $p < .01$. This is likely due to the fact that the phonemic repertoire and the syllable structure inventory of the Russian language is very similar in key ways to English. The Russians were therefore facilitated by positive transfer from their L1, whereas the Japanese were inhibited by negative transfer and had trouble isolating individual phonemes, some of which appeared in clustered onsets that are not present in the Japanese syllable repertoire.

Correlations among the variables, computed separately for the Japanese and the Russian speakers, appear in Table 2. Due to

Table 2

Correlations Among Variables Computed Separately for Russian and Japanese Groups

	1	2	3	4	5	6	7
1. Word recognition	—	.47	.16	–.42	–.08	.45	.14
2. Pseudoword decoding	.16	—	.29	–.11	.18	.47	.26
3. Orthographic knowledge (accuracy)	.22	.51*	—	–.20	.38	.05	.22
4. Orthographic knowledge (speed)	–.20	.10	–.02	—	–.20	–.19	–.11
5. Spelling recognition	.40	.56*	.26	.26	—	.12	.27
6. Pseudoword repetition	.02	.39	.02	–.09	.44	—	–.03
7. Phoneme deletion	–.06	.04	–.23	–.02	.08	–.27	—

Note: Correlations are above the diagonal for the Russian group and below the diagonal for the Japanese group.
*$p < .05$.

the small sample size, only correlations above .50 achieved significance, and caution is therefore required in the interpretation of these data. Of particular relevance are the significant correlations between pseudoword decoding and measures of orthographic processing for the Japanese speakers ($r = .51$ and .56 for orthographic knowledge and spelling recognition, respectively), suggesting that this group relies on a sensitivity to legitimate spelling patterns when decoding new words. The relation between pseudoword decoding and phoneme deletion is quite low for the Japanese speakers ($r = .04$), indicating that phonological processing is less implicated in reading than orthographic processing. For the Russian speakers, the correlation between pseudoword reading and phoneme deletion is surprisingly modest ($r = .26$, *ns*) and is not consistent with other studies showing significant relations between phonemic awareness and word reading. However, the Russian group's mean accuracy score on phoneme deletion was 92%, and this low correlation likely reflects restriction of range due to ceiling effects rather than a failure to support the hypothesized relation between L1 background and reading strategy.

Discussion

Earlier, the hypothesis was presented that L2 learners with poor phonological representations as a result of negative transfer may show reading behavior similar to that of individuals who are poor readers in their L1. This notion springs from the increasing number of studies comparing good and poor readers on a variety of tasks using paradigms from speech perception research (McBride-Chang, 1995). In this view, incoming acoustic-phonetic information is transformed into poor-quality phonological representations, which form the material upon which all reading-related activities are conducted, from naming, to encoding in working memory, to assigning pronunciation to nonwords. Under this hypothesis, it is clear that the deficiency of phonological representations is a pervasive but extremely subtle one, because children with specific reading disability may show no visible evidence of language dysfunction and may perform in the normal range on measures of expressive and receptive vocabulary. The non-nativelike quality of L2 learners' phonology, however, is often quite marked, standing in the way of listening comprehension often at advanced levels of reading and writing proficiency in the L2. It is this discrepancy between L1 and L2 that is of interest here. Children with native-language impairment may show problems with written language as well (Crain & Shankweiler, 1990; Mann, Liberman, & Shankweiler, 1980), but the dissociation of reading/writing from listening/speaking is usually not as dramatic in L1 as it often is in L2.

The comparison used in this experiment contrasted the processing profiles of two groups of ESL learners differing on the basis of L1 phonological and orthographic structure. As was shown in several other studies, a number of processing differences are apparent that may be predicted on the basis of L1 orthographic and phonological characteristics (Akamatsu, in press; Caravolas & Bruck, 1993; Chitiri, 1991; Durgunoglu & Oney, 1996; Koda, 1988; Suarez & Meara, 1989; Sun, 1992; Wade-Woolley & Geva, 1994).

Ostensibly, the L2 groups examined here appeared equal in a number of higher- and lower-order reading-related processes. The TOEFL scores indicate that the groups were equal at L2 reading comprehension and vocabulary; they were also equally adept at recognizing real words and assigning pronunciations to pseudowords. They also showed equal proficiency with pseudoword repetition, a test of basic working memory capacity in L2. In terms of specific phonological and orthographic processes, however, the two groups were predictably and significantly different. Relying on the strengths provided by their respective L1 orthographies, the Russians were more adept at manipulating sublexical phonological segments, whereas the Japanese were more accurate at recognizing legitimate spelling patterns in English.

In the present study, the Japanese appeared to show evidence of greater sensitivity to orthographic patterns and awareness of legitimate spelling structures than did the Russians, as evidenced by their superiority on the tasks tapping orthographic knowledge and spelling recognition. Even though the accuracy level on the overall measure of phoneme deletion shows that the Japanese were significantly poorer at phonemic awareness than the Russians, this was not reflected in differential performance on pseudoword decoding. This result is somewhat counterintuitive; as the literature review indicated, phonological awareness is believed to be a sine qua non underlying the ability to assign pronunciations to new words.

One characteristic of poor readers shared by the Japanese is a superior sensitivity to orthographic patterns, as shown in the orthographic choice and spelling recognition tasks. This finding, in studies where participants are compared to others at the same reading level (e.g., Campbell & Butterworth, 1985; Funnell & Davison, 1989; Siegel et al., 1995), may be a methodological artifact reflecting the fact that older, poor readers may have had more exposure to print and opportunity to build word-specific knowledge (Vellutino, Scanlon, & Tanzman, 1994). In studies where participants are matched for chronological age, however, poor

readers lag behind their normally achieving peers in both phonological processing and orthographic knowledge (e.g., Ellis, 1994; Ellis & Large, 1987; Frith, 1985). Although print exposure was shown to be an index of orthographic processing that is predictive of decoding and yet relatively independent of phonological influences (Stanovich & West, 1989), it is not immediately obvious that differences in print exposure are responsible for the finding that the Japanese are more successful than the Russians at identifying legitimate English spelling patterns. The number of years of formal schooling in English and age of onset of formal English instruction can be construed as indirect measures of print exposure. In the current study, however, the Russian speakers had received more years of English instruction than the Japanese speakers (9.4 and 8.5 years, respectively), beginning at an earlier age (9.9 and 12.2 years, respectively). As a result, one might expect, wrongly, that any advantage in print exposure that might emerge would favor the Russians rather than the Japanese. It therefore seems unlikely that print exposure can easily account for the Japanese speakers' superiority in identifying permissible orthographic patterns in English.

The Japanese speakers' superior performance on the orthographic choice task showed their ability to effectively discriminate between more and less legitimate orthographic representations. The Japanese speakers were consistently faster and more accurate than the Russians at making these decisions. Similar decisions were involved in the spelling recognition task, in which the Japanese again showed superior accuracy. These findings provide evidence to suggest that L2 readers arrive at their respective performance levels through qualitatively different approaches. The adopted strategy may be the result of L1 orthographic influences. Because Russian is alphabetic, phonological coding in English is likely to be a reliable and proven path to assigning speech equivalents to new words.

Supporting the notion that phonological information may be of less strategic value than orthographic information to Japanese readers are the correlations between pseudoword decoding and

two converging tasks tapping orthographic processing. For this group, L1 experience with kanji is likely to foster an awareness of holistic orthographic patterns that is transferred to English-language processing. Additionally, English teaching methodology in Japan tends to present new English words similarly to new kanji: as whole entities to be memorized. These instructional effects may compound basic processing strategies in which greater attention is allocated to sequential redundancies in letter strings. Japanese superiority may lie at the level of processing postulated by Vellutino et al. (1994), where orthographic processing is conceived of as

> at base, a visual coding ability that depends on such facets of the visual system as visual feature analysis, attention to visual detail, and visual pattern analysis, as well as on such general abilities as the ability to detect, represent and categorize invariance. (p. 322)

These results are consistent with the finding that poor readers have a greater facility with orthographic information than might be predicted on the basis of their phonological skills, as manifested by their superior performance on exception words over regular pseudowords and by more accurate word-specific knowledge than reading-level-matched peers (Siegel et al., 1995). Whatever the advantage experienced by poor readers in terms of orthographic knowledge, it does not compensate for their phonological processing deficits, given that by the definition of reading disability, the reading difficulty persists. For the Japanese speakers in the current study, it may appear as though orthographic processing compensates entirely for phonological awareness weakness, by virtue of their performance on pseudoword decoding at a level equal to that of the Russians. It is important, however, not to lose sight of the fact that although the normally achieving group is the standard against which the poor reading group is measured in traditional reading level match studies, the Russians' performance should not be used as an absolute benchmark in the same way. Even if the Russians and Japanese were in fact decoding pseudowords at the same level, that level may not be particularly high. Without an English-speaking control group

matched on word recognition there is no real standard by which to establish a valid level of reading skill for L2 speakers/learners.

The Russians showed their superior phonological skills in their accuracy at phoneme deletion; the Japanese were significantly less accurate at isolating individual phonemes and manipulating sublexical speech units. This was likely due to the fact that language transfer factors were operating on Japanese construction of phonological representations. The absence of consonant clusters in their first language was reflected in their lower accuracy at deleting phonemes from these complex onsets. It is important to note here that the age of the participants, their level of L2 proficiency, and the influence of literacy in L1 are all likely to have a significant impact on their performance. For example, at younger ages or at lower levels of L2 proficiency, the impact of phonological awareness may be quite different for these groups. Stanovich (1988) has pointed out that some relationships are developmentally limited; the causal relationship between variables may be particularly strong at early stages of development but become attenuated at a later point. On the other hand, phonological coding may be less important for nonalphabetic L1 speakers when learning to read an alphabetic L2. This possibility is made more credible in light of the results reported by Jackson, Chen, Goldsberry-Shaver, Kim, and Vanderweff (in press), where Taiwanese and Korean native speakers read English at a level high enough to pursue graduate studies in English, and yet demonstrated relatively weak pseudoword decoding skills.

In conclusion, it appears that adult Russian- and Japanese-speaking learners of English at a low-intermediate proficiency level in English show different profiles in their fluency and effectiveness at attending to linguistic and orthographic information in reading-related tasks. Despite the degree to which the L2 groups rely on different strategic strengths, however, there is evidence that both groups have the ability to integrate orthographic and phonological knowledge for reading in English. This is consistent with findings from L1 research suggesting that activation of both orthographic and phonological processes is key

for fluent reading (Berninger, Yates, & Lester, 1991; Cunningham & Stanovich, 1990; Olson, Wise, Connors, & Rack, 1990) and also from word reading studies in Japanese showing phonological activation involved in both kanji and kana (Leong & Tamaoka, 1995; Lindgren, DeRenzi, & Richman, 1985; Wydell, Patterson, & Humphreys, 1993). The strategy preferences and relative strengths displayed by each group may be predictable based on the characteristics of each language's orthographies; as are most speakers with alphabetic orthographies, the Russians are more efficient at sublexical speech manipulation of words, whereas the Japanese, due to their experience with kanji, show evidence of a greater sensitivity to visual information conveyed by orthographic patterns. As we have seen, however, these differences in group profiles may not be associated with any related differences in real or pseudoword reading. This suggests that speakers of different native languages may bring processing strategies specific to their L1s to the task of reading new and familiar words in a second language, but no differences in accuracy necessarily appear as a result of different strategy use, even when the L1 and L2 orthographies and phonologies vary widely. These are important findings for two reasons. First, they add further support to the evidence of crosslinguistic transfer effects on L2 reading. Second, they are relevant for researchers studying the relationship between phonological processing and reading difficulties, because they point to a need for a further conceptual refinement of the exact nature of deficient phonological processing leading to reading disability.

Revised version accepted 04 January 1999

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