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Bilingualism, Language Proficiency, and Learning to Read in Two Writing Systems

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Two hundred and four 5- and 6-year-olds who were monolingual English-, bilingual English–Chinese-, or Chinese-speaking children beginning to learn English (2nd-language learners) were compared on phonological awareness and word decoding tasks in English and Chinese. Phonological awareness developed in response to language exposure and instruction but, once established, transferred across languages for both bilinguals and 2nd-language learners. In contrast, decoding ability developed separately for each language as a function of proficiency and instruction in that language and did not transfer to the other language. Therefore, there was no overall effect of bilingualism on learning to read: Performance depended on the structure of the language, proficiency in that language, and instructional experiences with that writing system. These results point to the importance of evaluating the features of the languages and instructional context in which children become biliterate.

Keywords: bilingualism, learning to read, phonological awareness, second-language learning, language transfer

Models of literacy acquisition and early reading routinely take account of other relevant knowledge that children possess at the time they embark on literacy instruction (e.g., Adams, 1990; Carr, Brown, Vavrus, & Evans, 1990). Primary among such knowledge is metalinguistic awareness, particularly phonological awareness, widely acknowledged to be predictive of children's progress in learning to read (reviews in Adams, 1990; Castles & Coltheart, 2004). It should not be surprising, therefore, that knowledge of another language and skill in reading that language also influences children's literacy acquisition. However, this influence might diminish or even disappear for two languages that use different writing systems. As Coulmas (1989) points out, writing systems can be based primarily on morphemes (e.g., Chinese), syllables (e.g., Japanese), or phonemes (e.g., English), and the relation between the oral language and the notational system that encodes it in each system is different. Different levels of phonological awareness are required to acquire decoding skills in each system: Chinese character acquisition depends heavily on syllable awareness, whereas English word recognition depends primarily on phonological awareness (McBride-Chang, Bialystok, Chong, & Li, 2004). What happens, then, when children are learning to read in two languages based on different systems?

The differences between writing systems are associated with differences in instructional methods. Approaches to literacy instruction in Chinese and English differ markedly, particularly in Hong Kong where, unlike other Chinese societies, no phonological coding system is used, and instruction proceeds exclusively through rote memorization of characters (Cheung & Ng, 2003). Each Chinese character, representing a single syllable and morpheme, takes up the same amount of space on a page. The majority of Chinese words consist of two or more characters, and the same single character may appear in many different words; for example, the Chinese characters for university, adult, and elephant all share a character that conveys the sense of "big." Furthermore, the syllabic form is relatively simple, especially for Cantonese, which consists of consonant–vowel–consonant or consonant–vowel constructions with no consonant clusters. Thus, the syllable has great saliency in both spoken and written Chinese. In contrast, the importance of the phoneme is particularly clear in English, especially compared with Chinese (although languages with more regular orthography, such as Spanish, make the phoneme more salient). Spoken English includes multiple consonant clusters, perhaps fostering English-speaking children's sensitivity to the phoneme unit (Cheung, Chen, Lai, Wong, & Hills, 2001). The alphabetic principle of English in which letters represent sounds makes reliance on phonics an efficient and useful strategy for learning to read new words. Chinese has relatively little phonological consistency at the character level (e.g., McBride-Chang & Chen, 2003). Thus, decomposing Chinese characters into their phonetic compo-

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nents is not helpful for facilitating reading acquisition. As a result, Chinese has traditionally been taught with a strong emphasis on rote memorization of individual characters, whereas English reading is typically taught with some reliance on phonics training (e.g., McBride-Chang, 2004).

Both the potential for initial differences in metalinguistic awareness and the prior knowledge of another writing system lead to the prediction that learning to read will be different for bilingual children than for monolinguals. However, there may be a benefit of knowing how to read in another language, and this may depend on the similarity between the reading processes in the two languages determined largely by the comparability of the writing systems. The purpose of the present study is to examine the effect of bilingualism on learning to read in two languages that do not share a writing system. The study addresses two questions: The first is whether the acquisition of English literacy proceeds differently for children who also speak and are learning to read in a language that is written in a different writing system; the second is whether the literacy and corresponding phonological skills transfer across the two languages for children learning both systems.

One of the methodological challenges in studying bilingual development is that bilingualism is not a categorical variable that neatly divides populations into two groups. It is, rather, a continuous dimension that describes the relative proficiency that a person holds over two languages. We readily apply the term *bilingual* to someone equally fluent in two languages and refrain from using it for someone who knows only a modest amount of a second language, but there is much territory between those endpoints. Developmental research has found that the degree to which a child is bilingual is crucial in determining the cognitive and linguistic consequences of bilingualism. Beginning with the influential work of Cummins (1979), who postulated that bilingualism could benefit only those with a threshold level of proficiency in both languages, other investigators have reported different outcomes on cognitive and metalinguistic tasks for children who were either fully bilingual or only partially so (Bialystok, 1988; Bialystok & Majumder, 1998; Cromdal, 1999; Hakuta & Diaz, 1985; Ricciardelli, 1992). Thus, the effect of bilingualism depends on the child's level of language proficiency in the two languages, with modest advantages for partially bilingual children and more clearly positive outcomes for children with high levels of proficiency in both languages. By extension, degree of bilingualism may also mediate the interaction between children's literacy in one language and acquisition of literacy in another language.

The difference in degree of bilingualism is captured by a terminological distinction between *bilingualism*, referring to the control over two linguistic systems, and *second-language acquisition*, referring to the process of appending a new language to an established system. There are no clear boundaries between these two, and different investigators have set different criteria (e.g., Bialystok, 2001; Grosjean, 1989; Romaine, 1995). The transition from second-language learner to bilingual is likely continuous rather than categorical, but most investigators agree that some description of the relative level of language proficiency is important in interpreting potential effects of bilingualism. In the present study, differences in the degree of language proficiency were examined by comparing children who were bilingual, in that they lived in an environment where both languages were used and taught, with those who were second-language learners, in that one of the languages was encountered primarily as a school subject but not used much outside that context. For expository simplicity, *bilingualism* is used to refer to the whole scale of language proficiency, but *bilingual children* and *second-language learners* refer to children with specific linguistic competencies on this scale.

An important basis for the prediction that bilingualism will influence the acquisition of literacy comes from evidence that bilingualism enhances metalinguistic ability, including word awareness (Ben-Zeev, 1977; Cummins, 1978; Edwards & Christopherson, 1988; Ricciardelli, 1992; Yelland, Pollard, & Mercuri, 1993) and syntactic awareness (Galambos & Goldin-Meadow, 1990; Galambos & Hakuta, 1988). The most reliable metalinguistic prerequisite for reading in an alphabetic writing system is phonological awareness, but evidence for bilingual advantages in this regard has been more mixed. Some studies have reported early advantages for bilinguals (Bruck & Genesee, 1995; Campbell & Sais, 1995; Caravolas & Bruck, 1993; Chen et al., 2004), but the advantages often disappear by first grade when reading instruction begins and children are exposed to the same instructional experiences. Some effects have even been reported with very limited levels of bilingualism: Yelland, Pollard, and Mercuri (1993) asked children who were newly exposed to a second language to judge whether pictured objects had long names or short names. Early developing bilinguals performed better than monolinguals, but these differences also disappeared by the end of Grade 1. In contrast, a study by Bialystok, Majumder, and Martin (2003) found only limited differences in phonological awareness between monolinguals and bilinguals even in the preschool years. In that study, English–Spanish bilinguals outperformed both English–Cantonese bilinguals and monolinguals on a phoneme counting task, but there were no differences between monolinguals, English–French bilinguals, and English–Cantonese bilinguals in other phoneme-based tasks. The interpretation was that the English-Spanish bilinguals had acquired more explicit understanding of sound–symbol correspondences because of the regularity of Spanish orthography, and this helped to establish reliable concepts of phonetic structure. These results also reinforce the importance of considering the relation between the two languages when the effects of bilingualism on development are examined, a point noted as well by other researchers encountering interactions between bilingualism and the specific language pairs in tests of phonological awareness (Bruck & Genesee, 1995; Chen et al., 2004; Loizou & Stuart, 2003; Mumtaz & Humphreys, 2001).

The second reason to expect bilingual differences in the acquisition of literacy comes from the opportunity to transfer skill acquired in one language to the problem of reading in the other. The probability of such transfer depends on the similarity between the languages and the writing systems. Two languages written in an alphabetic system should be more amenable to skill transfer than would an alphabetic and a character language. The majority of studies investigating transfer of reading across languages has compared languages that are written in alphabetic systems. For example, Geva and colleagues examined children learning Hebrew or Persian in addition to English (Geva & Siegel, 2000; Gholamain & Geva, 1999; Wade-Woolley & Geva, 2000). A study by Arab-Moghaddam and Sénéchal (2001) failed to fully replicate this transfer for Persian and English, but the scores in that study appeared to be largely at ceiling, reducing the possibility of obtaining significant correlations. For alphabetic languages, how-

ever, the insight that letters make sounds is common to reading in both languages, and the establishment of that principle in one language can be transferred to the other. The results are different for languages using different writing systems. A study by Gottardo, Yan, Siegel, and Wade-Woolley (2001) recruited children from Chinese schools who were beginning to learn English, but the children in the sample varied widely in their English proficiency. The heterogeneity of the sample makes the results difficult to interpret, but the pattern indicated that children transferred their knowledge of reading from Chinese to English and profited from their earlier literacy. In contrast, studies comparing the transfer of literacy acquisition across languages in first-grade bilinguals found strong interlanguage correlation for children learning to read in English and either Spanish or Hebrew (Bialystok, Luk, & Kwan, 2005) but no correlation for children learning to read in English and Chinese (Bialystok et al., 2005; Luk, 2003).

Phonological awareness is a strong predictor of alphabetic reading, and evidence for its transfer across languages has been reported for Hebrew–English (Wade-Woolley & Geva, 2000), Spanish–English (Durgunoglu, Nagy, & Hancin-Bhatt, 1993), and Bahasa Malaysia–English (Gomez & Reason, 2002) bilingual children. Gottardo et al. (2001) found that Cantonese–English children's performance in Chinese rhyme detection correlated with English rhyme detection and phoneme deletion. The degree of transfer may depend on the level of phonological unit: Wade-Woolley and Geva (2000) reported stronger correlations across languages for large units of sound, such as rhyme detection, than for phonetic segments. Luk (2003) tested English–Chinese bilinguals who were all relatively balanced in their proficiency of Cantonese and English and found significant transfer of phonological awareness but no relation between reading skills in the two languages. However, the units of awareness for the phonological task were at the level of onset and rhyme rather than the level of phoneme.

Research examining the transfer of reading and phonological awareness across languages has been conducted with children who represent a variety of bilingual experiences, including both bilinguals and second-language learners. In immersion programs, such as Canadian French immersion or Hebrew day schools, children first encounter the new language when they enter school and learn to speak and read the language at the same time. These children have limited oral proficiency in the new language and, according to the present criteria, would be designated as second-language learners rather than bilinguals. Few studies, however, have systematically examined whether this difference is relevant for the acquisition of literacy and other skills. For example, Wade-Woolley and Geva (2000) studied children in Hebrew day schools and found strong relations between overall reading skills in English and Hebrew but no transfer for phonological awareness using phoneme deletion tasks. These results appear to contradict those of Luk (2003); however, unlike in Luk's study, both languages were alphabetic, and the children were second-language learners, not bilinguals. Moreover, the authors acknowledge that the lack of correlation in phonological awareness could be due to ceiling performance in both the English and Hebrew phoneme deletion tasks (Wade-Woolley & Geva, 2000, p. 303). Rickard Liow and colleagues identified constraints on correlations across languages for phonological and literacy skills attributable to the similarities of the writing systems (Rickard Liow, 1999; Rickard Liow & Poon, 1998). In general, the research indicates that phonological awareness skills develop in parallel across languages and that reading skills depend more strictly on language and writing system (Luk, 2003). In a large-scale factor analysis based on over 100 first-grade students with some competence in Spanish and English, Swanson, Sáez, Gerber, and Leafstedt (2004) reported that phonological awareness was based on language-independent working memory, but reading was based on language-specific resources. Therefore, in the absence of a common writing system, there should be correlation across languages for phonological awareness skills but no cross-language correspondence for reading skills, at least for children who are fully bilingual. Studies examining children who are second-language learners rather than full bilinguals have revealed stronger correlation between reading skills in the two languages irrespective of the writing systems involved (Swanson et al., 2004; Wade-Woolley & Geva, 2000).

In summary, evidence from previous research suggests that two reasons reading acquisition might proceed more efficiently for bilingual children than for monolinguals are (a) the earlier establishment of prerequisite skills and (b) the possibility of skill transfer across languages. In addition, two factors that intercede and modify these effects are (a) the degree of bilingualism, captured by the distinction between proficient bilinguals and early second-language learners, and (b) the extent to which the languages share a writing system, facilitating transfer of skill across languages. These factors and their interaction must be considered in an evaluation of the way in which bilingual children learn to read in their two languages.

The present study addressed these issues by comparing the acquisition of phonological awareness and word decoding in English and Chinese for children who were bilingual and children who were second-language learners. The difference between the writing systems allows transfer to be examined at a more abstract level than simple generalization of knowledge; the difference in proficiency for the two languages in the bilingual groups allows the role of linguistic knowledge to be examined in more detail. The first hypothesis was that the development of phonological awareness depends on language exposure and instruction but, once mastered, is applied equally to both languages. Therefore, children with access to instruction in an alphabetic system will have higher levels of phonemic awareness than those without that access (second-language learners) but all children will have comparable facility in syllabic awareness, which does not require specific instruction. Additionally, phonological awareness, once established, is a general cognitive skill that can be applied equivalently to both languages, and even equivalently to words and nonwords, for the bilinguals and second-language learners.

The second hypothesis was that progress in word decoding is more specific to knowledge and skill in each language, so performance will be related to children's level of linguistic competence, creating a disparity between the bilinguals and the second-language learners. In contrast to phonological awareness, word decoding in each language draws on language-specific processes, so there will be different levels of decoding ability found for the bilinguals and second-language learners in the two languages and for the two bilingual groups across languages. Thus, there will be different levels of achievement between the two bilingual groups and no transfer of skill across the two writing systems.

According to these hypotheses, the results should provide an integrated view of the development of phonological awareness and decoding ability in bilingual children by considering the relation between the writing systems, children's proficiency in the two languages, and differences in educational experiences. Because the bilingual children are compared with two groups—monolingual English speakers and Cantonese speakers studying English as a foreign language—it should be possible to determine whether bilingualism conferred any general effects on literacy acquisition, beyond language-specific effects. If it did, then the relationship between the performance of the bilingual group and each of the others should be the same; if it did not, different patterns would be expected. This perspective will contribute to a more general understanding of how bilingualism affects the acquisition of literacy.

Method

Participants

The study included three groups of children who were in kindergarten or Grade 1. Two of the groups lived in Canada, where the predominant language and language of schooling is English; the third group lived in Hong Kong, where the predominant language and language of schooling is Cantonese. The two Canadian groups lived in the same neighborhoods and attended the same schools, differing primarily in the language they spoke at home with their families. The mean age of the children in each group is reported in Table 1.

The first group consisted of 64 monolingual English speakers, divided evenly between kindergarten (14 boys and 18 girls) and first grade (18 boys and 14 girls). These children had no exposure to languages other than English, a criterion that was confirmed by parental questionnaire responses and teachers' reports. For both Canadian groups, English reading instruction was based on an eclectic system of phonics and meaning-based instruction.

The second group consisted of 70 English–Cantonese bilingual speakers, equally divided between kindergarten (16 boys and 19 girls) and first grade (18 boys and 17 girls). The bilingual experimenter confirmed that all the children could carry out casual conversations in both Cantonese and English. Children who were unable to converse easily in both languages were excluded from testing. A parental questionnaire, used to assess the children's home language and literacy environment, indicated that these children used Cantonese at home and in weekly Chinese literacy programs but attended the neighborhood schools where instruction was in English. The Chinese literacy programs followed the same teaching strategy as that used in Hong Kong schools, namely, rote character learning through "look and say," although children in Canada have significantly fewer hours of instruction than their counterparts in Hong Kong. The teacher wrote a character on the board, indicated the pronunciation, and the children read the character aloud and copied it several times. The teacher provided information about the meaning and use of the character by using it in some sentences. To the extent that it is possible for children of this age, these children were functionally bilingual.

The children in Hong Kong were similar to their Canadian counterparts socially and educationally. The group included 70 children divided equally between kindergarten (17 boys and 18 girls) and first grade (14 boys and 21 girls). These children spoke Cantonese at home and in the community and learned English as a school subject. School instruction was in Cantonese for all subjects except English language classes. As with the Cantonese classes for the bilingual children in Canada, the teachers in Hong Kong taught English through a look-and-say method, and the children learned English by rote memory. This same method was used for English reading instruction as well. Because of their limited exposure and proficiency, these children were English second-language learners rather than bilingual speakers.

Because the children in the different groups were receiving primary literacy instruction in different languages, it is inevitable that they had different instructional experiences. The alphabetic principle of English makes phonics teaching an integral component of early English word recognition instruction. In contrast, the nature of Chinese writing has traditionally been associated primarily with look-and-say rote memorization instruction (Wu, Li, & Anderson, 1999). As much as possible, we have tried to isolate these experiences from the other variables examined in the study.

Procedures and Tasks

All the tasks were reconstructed in parallel versions for both languages, and bilingual children completed the tests in both languages. Simple translation of the tasks was not possible, but the tasks were created to be as similar as possible. In some cases, the tasks appear to be more sensible for one language than for the other; phoneme awareness, for example, is not a salient concept for Chinese. However, it is impossible for tasks to be equivalent across languages, so the decision was to optimize the ability to compare the underlying skills across languages rather than the assessment of linguistic knowledge in each language. Therefore, tasks were constructed to assess similar concepts in the two languages.

The monolingual children completed testing in a single session. The bilingual children were tested twice, once in each language. The order of the languages was counterbalanced across groups and grade levels within groups. All tasks were presented in a fixed order.

1. Peabody Picture Vocabulary Tasks—III (PPVT–III; Dunn & Dunn, 1997; English and Cantonese). The PPVT–III is a standardized test of receptive vocabulary. The child is shown four pictures on a plate in a booklet, and the experimenter names one of them. The child is asked to point to the picture that corresponds to the word. The pictures are arranged

Table 1
Mean Age, Mean Score, and Standard Deviation on Vocabulary and Decoding Tests by Group

		Canadian monolingual				Canadian bilingual				Hong Kong L2 learners			
		Kindergarten		Grade 1		Kindergarten		Grade 1		Kindergarten		Grade 1	
Age and test	Maximum score	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Age (in months)		69.6	3.1	82.8	3.9	69.7	3.6	82.1	3.6	70.3	6.2	82.9	5.9
English PPVT–III (standard)		108.2	11.6	101.3	11.1	94.0	12.2	88.9	11.0	44.2	7.1	43.9	6.6
Chinese PPVT–III (standard)						86.4	20.9	92.3	21.6	130.2	20.4	125.4	21.6
English decoding	30	14.4	10.3	26.4	4.3	14.0	10.2	25.2	3.6	9.8	7.2	18.3	5.4
Chinese decoding	55					12.9	11.8	19.4	11.6	47.1	10.0	54.1	1.7

Note. L2 = second-language; PPVT–III = Peabody Picture Vocabulary Tasks—III.

in increasing order of difficulty of the named concept, and testing terminates when the child makes 8 errors in a set of 12 items. There are two versions, A and B, with different words in each of similar difficulty. In the present study, version A was administered to all participants in English, and version B was translated into Cantonese by a native Cantonese speaker to serve as the Chinese vocabulary test. The bilingual children received both versions of the test, and the monolingual children were given only version A. We calculated raw scores by subtracting the number of errors that the child made on all of the presented words from the number of the last item that the child received. We derived standard scores by comparing the child's raw score with a table that accounts for chronological age. The standard scores in English are normalized, but the standard scores in Chinese are only approximations to proficiency because the test was not standardized in Chinese, so comparisons should be interpreted with great caution. However, the standard scores are reported here and were used in the present analyses because they control for age, making them more meaningful than raw scores. The reported reliability for the English PPVT–III for children of this age is .93. Calculating a reliability coefficient from performance on the Chinese translation of this task produced a score of .97. All reliability coefficients reported in this study are Cronbach's alpha.

2. Syllable deletion (English and Cantonese). The syllable deletion task taps children's awareness of syllabic units in spoken language. Children were given 16 three-syllable items and were asked to reproduce the word without one of the syllables as specified by the experimenter. Half of the items were real words and the other half were nonwords modeled on the phonology of real words. The order of real words and nonwords was counterbalanced across groups and grades. Each trial began with the experimenter asking the child to repeat the stimulus, and then the experimenter specified one of the syllables to be deleted (e.g., a trial from the English real word items was "Say *new airport* without *new*," and a trial from the English nonword items was "Say *tig sard munt* without *sard*"). The deleted syllable could be in the onset, medial or final position. For real word items, the two-syllable string left after the deletion was also a real word. Five practice items were given with feedback prior to administration of the 16 experimental items. The score was the total number correct from the list of 16 items. The reliability coefficient for the English syllable deletion task was .83, and for the Chinese syllable deletion it was .84.

3. Phoneme onset deletion (English and Cantonese). This task required children to delete the first sound of a given word. As in the syllable deletion task, the task presented 8 real words and 8 nonwords in each language. The experimenter asked the child to repeat the word without the very first sound (e.g., a trial from the English real word items was "Say *cup* without the first */k/* sound," and a trial from the English nonword items was "Say *kouse* without the first */k/* sound"). For the real words, the remaining string was also a word. The order of real words and nonwords items was counterbalanced across groups and grades. Five practice items were given with feedback prior to administering the 16 experimental items. The score was the number correct out of the 16 items in each language. For English, the reliability coefficient for this task was .95, and for Chinese, the reliability coefficient was .97.

4. Phoneme counting (English). This task was used to assess the child's phoneme segmentation ability. The word list was adopted from a study by Bialystok et al. (2003). The child was told that the sounds in a word could be "spread out" to hear each sound separately. An example was provided: "The word 'cat' can be spread out to the sounds /k/ /æ/ /t/." Children were then taught to use their fingers or a set of counter chips to represent each sound and then count the total number of sounds they heard. Several training trials were provided with feedback before testing until it was clear the child understood the task. For the Canadian group, there were 8 items, and for the Hong Kong group, there were 15. This disparity was because of a technical error in data collection, so all scores were converted to proportions to make the results comparable. Items ranged in number of phonemes from two to five. The reliability of this task is .76.

This task was only administered in English because the concept of phoneme is not explicitly represented in Chinese speech or print. Although phonemes are present in Chinese (Hoosain, 1991), they are less accessible than in alphabetic languages and develop as consequence of acquiring alphabetic literacy (Cheung et al., 2001; Morais, Bertelson, Cary, Algeria, & Bertelson, 1979). A few items were pilot tested on adult native speakers of Cantonese and showed that none of the adults could solve any of them. Even for adults, phoneme-based tasks require instruction. For these reasons, the task is more difficult for the Hong Kong children irrespective of their level of phonological awareness, so it would not have been surprising if those children found the task disproportionately difficult. The task, however, provides an important assessment of children's detailed concept of phoneme and so was included, but it should be interpreted cautiously.

5. Word decoding (English and Cantonese). The decoding task was based on a list of simple words used in previous research. The English task consisted of 30 items used by McBride-Chang and Kail (2002) with Hong Kong and American children. Ability to read these words correlated with scores by the American children on the Woodcock Word Identification subtest, $r = .85$. The Chinese task was adapted from Ho and Bryant (1997) and consisted of 25 single-character items. Children who could correctly identify 10 or more of these characters were then given a set of 30 two-character words. The English task produced a reliability coefficient of .96, and the Chinese task yielded a reliability measure of .99.

Results

Vocabulary and Phonological Awareness

One-way analyses of variance (ANOVAs) at each grade level showed that there were no age differences across the three groups ($F < 1$) as reported in Table 1. Standard scores on the English PPVT–III, also reported in Table 1, were examined in a 2-way ANOVA for grade (2) and group (3) and showed a significant group effect, $F(2, 196) = 658.7$, $MSE = 103.50$, $p < .0001$, $\eta^2 = .86$, in which all three groups were different from each other (Scheffé, $p < .01$). Surprisingly, there was also an effect of grade in which younger children obtained higher standard scores than did older children, $F(1, 196) = 8.2$, $MSE = 103.50$, $p < .005$, $\eta^2 = .01$, with no interaction between grade and language group. Because standard scores are corrected for age, this effect indicates a general difference between the grades in vocabulary knowledge. In contrast, a 2-way ANOVA on the Chinese PPVT–III scores showed that the Hong Kong second-language learners knew more Chinese vocabulary than did the Canadian bilinguals, $F(1, 135) = 115.1$, $MSE = 446.50$, $p < .0001$, $\eta^2 = .46$. This time there was no effect of grade, the expected result for standard scores.

The results of the English and Chinese PPVT tasks support the classification of the Canadian and Hong Kong groups as bilingual and second-language learners, respectively. For the Canadian group, there was no difference between scores on the English and Chinese vocabulary tests, $F(1, 69) = 1.3$, $MSE = 346.50$, *ns*, but the Hong Kong group scored higher on the Chinese test than on the English test, $F(1, 67) = 1123.0$, $MSE = 214.10$, $p < .0001$, $\eta^2 = .94$. Again, these differences are not direct comparisons because the Chinese test is not standardized, but the pattern of language difference in performance is consistent with the claim that the bilinguals in Canada were reasonably competent in Chinese, their weaker language, whereas the Hong Kong children had poor command of English. We obtained the same results using raw scores from the PPVT–III to avoid the problem of accounting for age by standardizing the scores. In this case, there was no differ-

ence between PPVT scores for the Canadian bilinguals ($F < 1$) but higher Chinese scores by the Hong Kong second-language learners, $F(1, 68) = 894.8$, $MSE = 417.00$, $p < .0001$.

A series of 3-way ANOVAs for grade, group, and word–nonword in the phonological awareness tasks found a difference between words and nonwords only for the English syllable awareness task, $F(1, 198) = 46.0$, $MSE = 1.40$, $p < .0001$, $\eta^2 = .19$, in which scores were higher for words than for nonwords. Because there were no differences between words and nonwords for the other tasks, and no interactions between this factor and any other variable, words and nonwords were combined in subsequent analyses for ease of exposition. The absence of a difference between scores on the word and nonwords items is consistent with the first hypothesis in which it was predicted that phonological awareness is equally available for different languages and for words or nonwords within languages.

The scores on the English phonological awareness tasks were converted to proportions to facilitate comparison across tasks and are plotted in Figure 1. These scores were analyzed with two-way ANOVAs for grade and group. There were different patterns for the three tasks, depending in part on the phonological unit involved. For syllable deletion, all three groups were equivalent ($F < 1$), and in each case, older children were more advanced than younger ones, $F(1, 198) = 23.5$, $MSE = 0.05$, $p < .0001$, $\eta^2 = .10$, with no interaction between language group and grade ($F < 1$). There was a language group difference for the phoneme deletion task, $F(2, 198) = 101.1$, $MSE = 0.05$, $p < .0001$, $\eta^2 = .40$, in which the Hong Kong second-language learners obtained lower scores than the other two groups (Scheffé, $p < .01$). There was also a grade effect, $F(1, 198) = 78.6$, $MSE = 0.05$, $p < .0001$, $\eta^2 = .16$, and an interaction of grade and language group, $F(2, 198) = 13.4$, $MSE = 13.20$, $p < .0001$, $\eta^2 = .05$, because in Hong Kong there was no difference between the scores of the kindergarten children and those in first grade, as there was for the other two groups. Finally, there was a group difference in phoneme counting, $F(2, 198) = 39.3$, $MSE = 0.04$, $p < .001$, $\eta^2 = .23$, that reflected a disparity between the Hong Kong group and the Canadian monolingual group (Scheffé, $p < .01$), with the Canadian bilingual group not different from either of these. First-grade children scored higher than kindergarten children, $F(1, 198) = 61.6$, $MSE = 0.04$, $p < .0001$, $\eta^2 = .18$, but the interaction between grade and language group, $F(2, 198) = 4.8$, $MSE = 0.04$, $p < .01$, $\eta^2 = .03$, indicated that this difference did not apply to the children in the Hong Kong group. Therefore, in phoneme deletion and phoneme counting, the older children in Canada performed better than their younger counterparts, but there was no grade-related improvement between the samples in Hong Kong on these tasks. To summarize, the three groups were equivalent for the syllable-based task, the easier phoneme-based task showed the bilinguals to be as good as the monolinguals, and the most difficult phoneme counting task indicated a greater discrepancy between the ability of the three groups.

The proportion correct for the Chinese phonological awareness tasks are plotted in Figure 2. These data were analyzed with 2-way ANOVAs for group (2) and grade (2). The Hong Kong second-language learners solved more Chinese syllable deletion items than the Canadian bilinguals, $F(1, 136) = 9.5$, $MSE = 0.05$, $p < .003$, $\eta^2 = .06$, and first-grade children solved more items than kindergarten children, $F(1, 136) = 16.1$, $MSE = 0.05$, $p < .0001$, $\eta^2 = .10$, with no interaction. In contrast, the Canadian bilinguals scored higher on the Chinese phoneme onset deletion tasks, $F(1, 136) = 88.0$, $MSE = 0.09$, $p < .0001$, $\eta^2 = .33$, older children outscored younger ones, $F(1, 136) = 34.1$, $MSE = 0.09$, $p < .0001$, $\eta^2 = .13$, and there was an interaction of group and grade, $F(1, 136) = 7.1$, $MSE = 0.09$, $p < .01$, $\eta^2 = .03$, with the grade improvement stronger in the Canadian bilingual group than in the Hong Kong group. This pattern is similar to that for the English phonological awareness tasks, in which the group difference is small or nonexistent for syllable-based tasks but large for phoneme-based tasks.

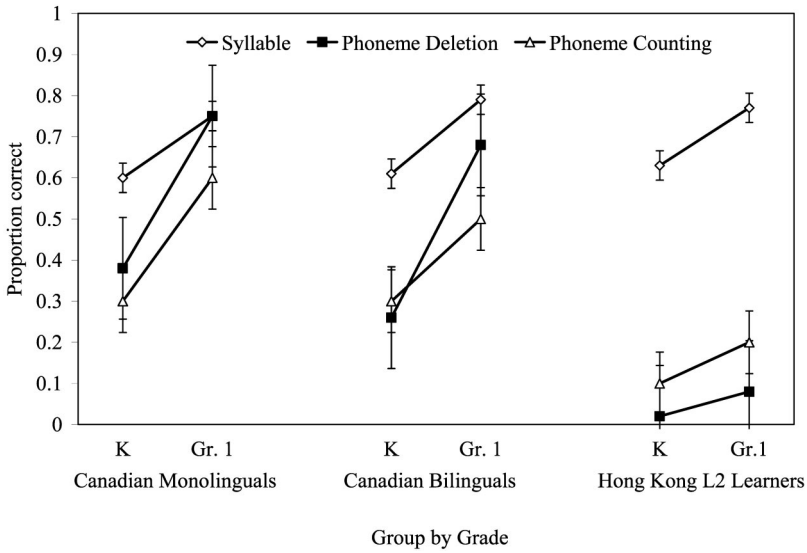

Figure 1. Proportion correct on English phonological awareness tasks by grade and language group. Error bars indicated standard errors of the mean. K = kindergarten; Gr. 1 = Grade 1; L2 = second language.

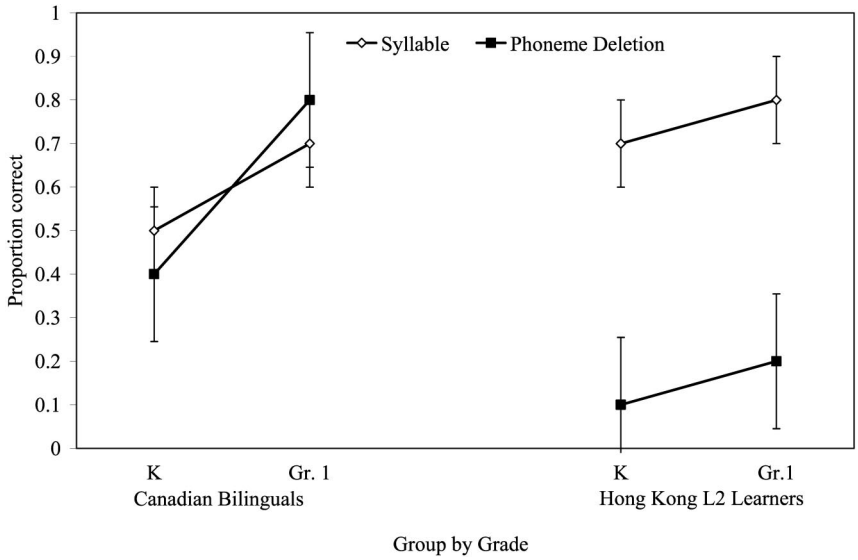

Figure 2. Proportion correct on Chinese phonological awareness tasks by grade and language group. Error bars indicated standard errors of the mean. K = kindergarten; Gr. 1 = Grade 1; L2 = second language.

Irrespective of the language, the Hong Kong second-language learners have difficulty analyzing words at the level of phoneme.

Effect of Bilingualism on Decoding

We addressed the effect of bilingualism on early decoding ability by comparing performance across the three groups. These scores are reported in Table 1. For English decoding, a two-way ANOVA for grade and group showed a significant group effect, $F(2, 197) = 15.4$, $MSE = 53.10$, $p < .0001$, $\eta^2 = .09$, caused by the lower performance of the Hong Kong group compared with the other two (Scheffé, $p < .01$). Older children identified more words than younger children, $F(1, 197) = 107.0$, $MSE = 53.10$, $p < .0001$, $\eta^2 = .32$, with no interaction, $F(2, 197) = 1.1$, *ns*. For Chinese word identification, there was a group difference, $F(1, 136) = 441.8$, $MSE = 94.20$, $p < .0001$, $\eta^2 = .74$, and grade difference, $F(1, 136) = 16.8$, $MSE = 94.20$, $p < .0001$, $\eta^2 = .03$, and again no interaction, $F < 1$. The bilingual children in Canada, therefore, decoded English words as well as their monolingual peers in spite of their experience in speaking and reading Chinese but were less proficient in Chinese than were those for whom it was the dominant language. Additionally, the group differences in their ability to solve the decoding task in each language was maintained over the 2 years examined.

It is not surprising that the Canadian bilinguals had lower Chinese decoding scores than the Hong Kong second-language learners for whom Chinese was their main language and that the Hong Kong second-language learners had lower English decoding scores than the Canadian bilinguals whose English was far more proficient. Children not living in the majority language community have less access to that language and less instruction in reading that language, even though the bilingual children in Canada could carry on conversations with equal ease in both languages. Therefore, we recalculated decoding scores in terms of the formal knowledge children had of each language by using PPVT–III standard scores for that language as a covariate. This recalculation assesses children's proficiency relative to their formal knowledge of that language. The least square means and standard errors obtained from these analysis of covariance models are reported in Table 2. For English reading, there was no difference between groups in kindergarten grade once vocabulary was controlled, $F < 1$. In contrast, there was a significant group effect for the Grade 1 children, $F(2, 97) = 3.1$, $MSE = 20.60$, $p < .05$, $\eta^2 = .04$, caused

Table 2
Least Square Mean Scores and Standard Errors on Word Decoding by Group With PPVT–III Vocabulary Score as Covariate

	Canadian monolingual				Canadian bilingual				Hong Kong L2 learners			
	Kindergarten		Grade 1		Kindergarten		Grade 1		Kindergarten		Grade 1	
Word decoding	*M*	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*
English	10.8	2.8	25.9	1.4	12.3	1.9	24.9	0.9	15.2	3.7	19.1	1.8
Chinese					12.8	2.3	20.7	1.6	47.3	2.3	52.7	1.6

Note. PPVT–III = Peabody Picture Vocabulary Tasks—III; L2 learners = second-language learners.

by the lower performance of the Hong Kong group relative to the other two. Formal literacy instruction begins in Grade 1, and this instruction propelled progress for children in Canada. The analysis of covariance for the decoding scores in Chinese that controlled for PPVT–III level continued to detect group differences at both kindergarten, $F(1, 67) = 79.0$, $MSE = 122.00$, $p < .0001$, $\eta^2 = .34$, and Grade 1, $F(1, 66) = 163.9$, $MSE = 67.10$, $p < .0001$, $\eta^2 = .43$, with Hong Kong children identifying more characters than the Canadian bilingual children in both grades. Therefore, the effect of instruction was more pronounced for the Canadian sample than for the children in Hong Kong.

Transfer of Skill Across Languages

The final question was whether phonological awareness and decoding ability transfer across languages for children who are becoming biliterate. We calculated these relationships by controlling for children's proficiency in each language using PPVT–III standard scores as a covariate. The partial correlations with English and Chinese PPVT–III standard scores controlled are reported in Table 3 separately for each of the two grade levels, although the patterns are largely the same. Only three correlations are different across grade levels, and none of these pertains to transfer of the same task across languages. These correlation coefficients indicating the association between the same tasks in the two languages are shown on the diagonal. For the Canadian bilinguals, the cross-language phonological awareness measures correlated with each other, with the exception of phoneme onset deletion and syllable deletion for the younger participants. Chinese phonological awareness measures correlated with English word decoding (except for syllable deletion and word decoding in the older participants), but none of the English measures correlated with Chinese character decoding. Most important, there was no relation between decoding in English and in Chinese. For the Hong Kong group, phonological awareness was correlated across languages only when the task was the same. For decoding scores, Chinese character identification was related to English syllable awareness, but only for the older children. In other words, decoding in each language was related to the phonological awareness skill in the other language most relevant for that writing system (McBride-Chang et al., 2004). Finally, unlike the results for the bilingual group, there was a strong correlation between decoding scores in the two languages for the Hong Kong second-language learners.

Table 3
Second-Order Correlations Between English and Chinese Phonological Awareness and Decoding Measures, With English and Chinese Standard Vocabulary Scores Partialed Out by Group and Grade

	Chinese task		
English task	1	2	3
Kindergarten			
Canadian bilinguals ($n = 35$)			
1. Syllable deletion	.54**	.36*	−.21
2. Phoneme onset deletion	.18	.52**	−.12
3. Word reading	.39**	.50**	.01
Hong Kong L2 learners ($n = 33$)			
1. Syllable deletion	.65**	.04	.31
2. Phoneme onset deletion	.27	.86**	.11
3. Word reading	.08	.02	.57**
Grade 1			
Canadian bilinguals ($n = 35$)			
1. Syllable deletion	.68**	.44*	.23
2. Phoneme onset deletion	.40*	.67**	.07
3. Word reading	.29	.41*	.18
Hong Kong L2 learners ($n = 34$)			
1. Syllable deletion	.83**	.22	.61**
2. Phoneme onset deletion	−.01	.55**	.09
3. Word reading	.10	.24	.39*

Note. L2 = second language.
* $p < .05$. ** $p < .01$.

Discussion

Children who were monolingual English speakers, bilingual English–Cantonese speakers, or Cantonese speakers learning English as a second language demonstrated different progress in their acquisition of early literacy and phonological awareness. Comparing each of the two bilingual groups to the monolinguals solving the tasks in English and to each other for both the English and Cantonese tasks helps to isolate the role of bilingualism in the acquisition of these skills. The results showed no overall influence of bilingualism but a relationship between children's level of proficiency in each language, their progress in literacy development, and the relation between the two writing systems. This broader perspective helps to resolve conflicting results in the literature for the role of bilingualism in developing these skills.

A crucial factor in discriminating among the three groups in their performance on the decoding tasks was their proficiency in each language as assessed by the receptive vocabulary test. The PPVT–III scores confirmed that the bilingual children in Canada had similar oral facility in both their languages and that the children in Hong Kong were much stronger in Chinese and just beginning to learn English. The vocabulary scores of the Hong Kong children were particularly high, but this is likely a reflection of Chinese word-forming principles. In Chinese, each syllable is a morpheme that contributes semantic information about the overall meaning of a word, so it is possible that children were better able to guess the meanings of unfamiliar words in Chinese by relying on the cues given by their morphemic structure. The conversion of the Chinese PPVT–III scores to standard scores is not an attempt to normalize these scores or make them directly comparable to the English PPVT standard scores but to express children's vocabulary in a way that has accounted for their age. Because these PPVT standard scores are not central to the analyses and the same within-group contrasts were obtained using raw scores, they were retained as approximations to vocabulary that allowed the bilingual children to be compared across their two languages and across the two groups. Consistent with previous research, however, the English skills of the bilingual children were still lower than those of monolingual English-speaking children (Oller & Eilers, 2002, for review), and their scores in Chinese, a language they only heard at home, were especially weak. It is rare for young bilingual children to master both of their languages to the same level as monolinguals because their experiences in each language are in-

evitably less rich—Grosjean (1989) has cautioned that bilinguals are not "two monolinguals in one." The important feature of these linguistic profiles is the relative balance in language ability for the bilingual children and the asymmetry in skill development for the second-language learners. Hence, the children in the three groups approached the experimental problems with different language experiences and different degrees of competence in each language.

The acquisition of the phonological concepts assessed in the three tasks used in the present study was also different for the three groups and shaped partly by differences between the accessibility of phonological units in English and Cantonese. However, when a particular phonological concept was mastered, it was equally available for both languages, irrespective of the child's proficiency in that language. Syllable structure is easily identified, especially in Chinese, and children's ability to analyze words into syllabic units was the same for all groups and strongly related across languages for each child. Awareness of phonemes is more difficult in Chinese, and the children in Hong Kong performed less well than both groups of Canadian children on phoneme-based tasks. Nonetheless, these children transferred their limited abilities to solve tasks based on phoneme onset awareness across their languages (r = .67) and to both words and nonwords, even though those abilities were not well developed. Furthermore, an additional year of literacy instruction did not enable the older children in Hong Kong to analyze words at the phonemic level more accurately than their younger peers, presumably because reading instruction in Hong Kong is not organized around awareness of phonemes. Therefore, the emergence of awareness for a particular phonemic unit depends on both the accessibility of that unit in the child's more familiar language and instruction to develop the skill. Phonological awareness is not a unitary skill but consists of unit-based components that become available for any language that the child knows. Just as the skill was applied equally to words and nonwords, it could probably be applied as well to a completely unknown language.

Previous research has reported contradictory results for the role of bilingualism in establishing phonological awareness. Our conclusion is that bilingualism on its own has little direct role in influencing the establishment of these concepts. The present results support those that have found no privileged acquisition of phonological awareness for bilinguals but point to the importance of language and language proficiency in this development. The bilingual children in Canada demonstrated no advantage over monolinguals in their proficiency with English phonological awareness tasks and, like the children in Hong Kong, revealed strong correspondence in their ability to apply these skills to both languages. These results reflect a bias for English to enable phoneme awareness and Chinese to promote syllable awareness, a point made as well by others (Cheung et al., 2001; McBride-Chang & Chen, 2003). Therefore, phonological awareness develops in part as a consequence of experience with particular languages (Bruck & Genesee, 1995, for differences between English and French in promoting phonological awareness), is not mitigated by bilingualism per se (Bialystok et al., 2003, for comparisons of three groups of bilinguals solving the same phonological awareness tasks), and is readily applied to both languages (i.e., transfers) for bilingual children (Luk, 2003, for a large sample of Chinese–English bilinguals solving similar problems).

The results of the decoding task indicated a different pattern; in this case, language proficiency did matter. In contrast to phonological awareness, decoding skills need to be built up separately for each language or each writing system. Also unlike phonological awareness, establishing the skill in one language or system does not guarantee that it will be available to carry out the same task in the other language, at least in two writing systems as diverse as Chinese and English.

Previous research with bilingual children has often reported transfer of decoding skills across languages in the early stages of literacy (e.g., Geva & Siegel, 2000). However, this generalization is limited by the relation between the writing systems; for languages written in different systems, there is no evidence for such transfer (Gottardo et al., 2001; Huang & Hanley, 1994). This pattern did not apply to second-language learners where a strong correlation between decoding scores in English and Chinese was obtained. Considering both the absolute achievement in reading proficiency and the scores adjusted for vocabulary knowledge, the bilingual children in Canada identified English words with the same proficiency as their monolingual peers. At the same time, being bilingual did not help them to progress in their mastery of Chinese reading, showing no general effect of bilingualism on progress with literacy.

There was, however, a striking difference between the bilingual group and the second-language learners: For the Canadian bilinguals, there was no correlation between progress in learning to read in the two languages, $r(70) = .19$, but for the Hong Kong children, there was a strong relation between these scores, $r(69) = .59$. The analytic skills the Canadian children had developed to read in English did not help in acquiring a larger base of reading vocabulary in Chinese, a process based largely on character memorization. Therefore, the abilities that supported English reading could not be recruited for Chinese reading, and the two scores remained unrelated. The children in Hong Kong, in contrast, were more advanced in learning to read in Chinese and were only beginning to make progress in learning to read in English. In this case, transferring their memorization strategy to English resulted in poor overall performance on English word reading because the strategy has only a limited effectiveness for English reading, and only at the early stages. Nonetheless, reading in English and Chinese are based on the same cognitive strategy and limited by the same memory resources, so the scores should be related, as the evidence indicated. Thus, the correlation between decoding in the two languages for the Hong Kong children may be attributable to the memorization strategy used for both writing systems because these children had not yet developed the analytic skills that would allow them to read new words. Reading instruction in each setting explicitly promoted one of these strategies—phonetic analysis in Canada and memorization in Hong Kong. Children at the early stages of English reading, namely those in Hong Kong, would only progress once a different set of word identification strategies was learned. The bilinguals in Canada already had established two different approaches to word identification.

One test of this interpretation is to examine bilingual children in Canada at the earliest stages of reading in English, making them more similar to the second-language learners in Hong Kong. Fifteen children in the Canadian bilingual sample at the low end of the distribution of English reading scores scored more than one standard deviation below the sample mean. All these children were

in the younger group. For these children, there was a significant correlation between reading scores in English and Chinese, $r(15) = .73$, $p < .002$, replicating the pattern found for the children in Hong Kong. The distributions for these scores were normal and a scatterplot of this subset of data displays a linear relationship within reasonable ranges (0–7 for English decoding and 0–31 for Chinese decoding). Therefore, the strong correlation was not caused by restriction of range. For the remaining 55 children in the sample whose English reading was in the normal range, there was no correlation between reading scores in the two languages, $r(55) = .20$, *ns*. Our interpretation is that children at the earliest stages of reading apply a single approach to both systems. Real development of literacy abilities requires mastering the unique approach required for each writing system.

The results also point to the crucial role of instruction in establishing children's early reading ability. For reasons entirely plausible given differences in the writing systems, English reading is taught largely through focusing children's attention on the phonological structure of words and Cantonese reading, through the memorization of characters. The majority of Chinese characters need to be formally taught, so children's progress in reading is naturally correlated with the amount of class time. For this reason alone, it is not surprising that the Hong Kong children and the Canadian children controlled different amounts of sight vocabulary. More important, though, is the type of skill that each instructional approach equips children with as they encounter new words. For English learning, children can begin to attack novel words after a relatively short exposure to English reading instruction, although more exposure than the Hong Kong children had received at the time of testing. Therefore, the monolingual and bilingual children in Canada were equally equipped to perform the English decoding task. Cantonese, in contrast, is somewhat generative as well, but only through the recognition of character components. Children would need to have mastered a large sight vocabulary before this helps, but the children in Hong Kong, especially the older ones, may have learned a sufficient base of characters that they could predict new words, increasing the gap again between them and the Canadian bilinguals. The point is that the effect of bilingualism cannot be separated from language, orthography, instruction, and culture.

There were two reasons for expecting literacy skills to develop differently in monolingual and bilingual children. The first was the possibility that bilinguals acquire the prerequisite phonological skills more readily than monolinguals; the second was the potential for transferring skills learned in one language to similar problems in the other. Both reasons were based on literature sampling a homogeneous group of children learning two related languages, and the results of the present study revealed the importance of considering children's level of bilingualism, the relation between the writing systems, and educational differences in instruction in these generalizations. Varying the level of bilingualism pointed to a fundamental difference between phonological awareness, which transfers readily across languages, and early decoding ability, which does not. The exception is in the earliest stages of learning alphabetic reading, where a single strategy is applied to the words, and reading in both an alphabetic and character system is constrained by the same cognitive abilities. Using languages with different writing systems pointed to underlying differences in the processes recruited to read in different systems, setting clear limits on the transferability of these skills. Finally, assessing children at two different grade levels indicated the role of instruction and development in the acquisition of these skills. The main finding here is that in the absence of explicit training, children in Hong Kong made no progress in phonological awareness at the level of phonemes.

The present results extend those reported in previous research and help to resolve contradictions in the literature regarding the role of bilingualism in the establishment of early literacy skills. There is no evidence for a monolithic effect of bilingualism in this development but, rather, a series of interactions with the variables manipulated in the present study. For phonological awareness, progress depends mostly on the structure of the language; for reading, progress depends mostly on proficiency in that language. Therefore, the results show that children's acquisition of literacy for languages with different writing systems depends on the structure of the language and less on children's abilities to perform these tasks in another language. As these results indicate, decoding skills in each language are based on different components, so a simple transfer of ability across languages would not be expected. In addition, the distinction between bilingualism and second-language acquisition led to different approaches to reading in each of the languages. Reading in two different writing systems does not readily transfer across systems but must be learned individually. Only children at the lowest levels of reading and language proficiency—namely the Hong Kong second-language learners and the lower English proficiency bilinguals in Canada—were, for the moment at least, developing their English reading skills in relation to their level of Chinese reading. In summary, therefore, bilingualism exerts its effect on literacy acquisition through a variety of factors and circumstances that must be accounted for individually in understanding how these children become literate in their two languages.

References

Adams, M. J. (1990). *Beginning to read: Thinking and learning about print.* Cambridge, MA: MIT Press.

Arab-Moghaddam, N., & Sénéchal, M. (2001). Orthographic and phonological processing skills in reading and spelling in Persian/English bilinguals. *International Journal of Behavioral Development, 25,* 140–147.

Ben-Zeev, S. (1977). The influence of bilingualism on cognitive strategy and cognitive development. *Child Development, 48,* 1009–1018.

Bialystok, E. (1988). Levels of bilingualism and levels of linguistic awareness. *Developmental Psychology, 24,* 560–567.

Bialystok, E. (2001). *Bilingualism in development: Language, literacy and cognition.* New York: Cambridge University Press.

Bialystok, E., Luk, G., & Kwan, E. (2005). Bilingualism, biliteracy, and learning to read: Interactions among languages and writing systems. *Scientific Studies of Reading, 9,* 43–61.

Bialystok, E., & Majumder, S. (1998). The relationship between bilingualism and the development of cognitive processes in problem-solving. *Applied Psycholinguistics, 19,* 69–85.

Bialystok, E., Majumder, S., & Martin, M. M. (2003). Developing phonological awareness: Is there a bilingual advantage? *Applied Psycholinguistics, 24,* 27–44.

Bruck, M., & Genesee, F. (1995). Phonological awareness in young second language learners. *Journal of Child Language, 22,* 307–324.

Campbell, R., & Sais, E. (1995). Accelerated metalinguistic (phonological) awareness in bilingual children. *British Journal of Developmental Psychology, 13,* 61–68.

Caravolas, M., & Bruck, M. (1993). The effect of oral and written language input on children's phonological awareness: A cross-linguistic study. *Journal of Experimental Child Psychology, 55,* 1–30.

Carr, T. H., Brown, T. L., Vavrus, L. G., & Evans, M. A. (1990). Cognitive skill maps and cognitive skill profiles: Componential analysis of individual differences in children's reading efficiency. In T. H. Carr & B. A. Levy (Eds.), *Reading and its development: Component skills approaches* (pp. 1–55). New York: Academic Press.

Castles, A., & Coltheart, M. (2004). Is there a causal link from phonological awareness to success in learning to read? *Cognition, 91, 77*–111.

Chen, X., Anderson, R. C., Li, W., Hao, M., Wu, X., & Shu, H. (2004). Phonological awareness of bilingual and monolingual Chinese children. *Journal of Educational Psychology, 96,* 142–151.

Cheung, H., Chen, H.-C., Lai, C. Y., Wong, O. C., & Hills, M. (2001). The development of phonological awareness: Effects of spoken language experience and orthography. *Cognition, 81,* 227–241.

Cheung, H., & Ng, L. K. H. (2003). Chinese reading development in some major Chinese societies: An introduction. In C. McBride-Chang & H.-C. Chen (Eds.), *Reading development in Chinese children* (pp. 3–17). Westport, CT: Praeger.

Coulmas, F. (1989). *The writing systems of the world.* Oxford, England: Blackwell.

Cromdal, J. (1999). Childhood bilingualism and metalinguistic skills: Analysis and control in young Swedish-English bilinguals. *Applied Psycholinguistics, 20,* 1–20.

Cummins, J. (1978). Bilingualism and the development of metalinguistic awareness. *Journal of Cross-Cultural Psychology, 9,* 131–149.

Cummins, J. (1979). Linguistic interdependence and the educational development of bilingual children. *Review of Educational Research, 49,* 222–251.

Dunn, L. M., & Dunn, L. M. (1997). *Peabody Picture Vocabulary Test—III.* Circle Pines, MN: American Guidance Service.

Durgunoglu, A. Y., Nagy, W. E., & Hancin-Bhatt, B. J. (1993). Cross-language transfer of phonological awareness. *Journal of Educational Psychology, 85,* 453–465.

Edwards, D., & Christopherson, H. (1988). Bilingualism, literacy and metalinguistic awareness in preschool children. *British Journal of Developmental Psychology, 6,* 235–244.

Galambos, S. J., & Goldin-Meadow, S. (1990). The effects of learning two languages on levels of metalinguistic awareness. *Cognition, 34,* 1–56.

Galambos, S. J., & Hakuta, K. (1988). Subject-specific and task-specific characteristics of metalinguistic awareness in bilingual children. *Applied Psycholinguistics, 9,* 141–162.

Geva, E., & Siegel, L. S. (2000). Orthographic and cognitive factors in the concurrent development of basic reading skills in two languages. *Reading and Writing: An Interdisciplinary Journal, 12,* 1–30.

Gholamain, M., & Geva, E. (1999). Orthographic and cognitive factors in the concurrent development of basic reading skills in English and Persian. *Language Learning, 49,* 183–217.

Gomez, C., & Reason, R. (2002). Cross-linguistic transfer of phonological skills: A Malaysian perspective. *Dyslexia, 8,* 22–33.

Gottardo, A., Yan, B., Siegel, L. S., & Wade-Woolley, L. (2001). Factors related to English reading performance in children with Chinese as a first language: More evidence of cross-language transfer of phonological processing. *Journal of Educational Psychology, 93,* 530–542.

Grosjean, F. (1989). Neurolinguists, beware! The bilingual is not two monolinguals in one person. *Brain and Language, 36,* 3–15.

Hakuta, K., & Diaz, R. (1985). The relationship between degree of bilingualism and cognitive ability: A critical discussion and some new longitudinal data. In K. E. Nelson (Ed.), *Children's language* (Vol. 5, pp. 319–344). Hillsdale, NJ: Erlbaum.

Ho, C. S.-H., & Bryant, P. (1997). Phonological skills are important in learning to read Chinese. *Developmental Psychology, 33,* 946–951.

Hoosain, R. (1991). *Psycholinguistic implications for linguistic relativity: A case study of Chinese.* Hillsdale, NJ: Erlbaum.

Huang, H.-S., & Hanley, J. R. (1994). Phonological awareness and visual skills in learning to read Chinese and English. *Cognition, 54,* 73–98.

Loizou, M., & Stuart, M. (2003). Phonological awareness in monolingual and bilingual English and Greek five-year-olds. *Journal of Research in Reading, 26,* 3–18.

Luk, G. (2003). *Exploring the latent factors behind inter-language correlations in reading and phonological awareness.* Unpublished master's thesis. York University, Toronto, Ontario, Canada.

McBride-Chang, C. (2004). *Children's literacy development.* New York: Oxford University Press.

McBride-Chang, C., Bialystok, E., Chong, K. K. Y., & Li, Y. (2004). Levels of phonological awareness in three cultures. *Journal of Experimental Child Psychology, 89,* 93–111.

McBride-Chang, C., & Chen, H.-C. (2003). *Reading development in Chinese children.* Westport, CT: Praeger.

McBride-Chang, C., & Kail, R. V. (2002). Cross-cultural similarities in the predictors of reading acquisition. *Child Development, 73,* 1392–1407.

Morais, J., Cary, L., Alegria, J., & Bertelson, P. (1979). Does awareness of speech as a sequence of phones arise spontaneously? *Cognition, 7,* 323–331.

Mumtaz, S., & Humphreys, G. W. (2001). The effects of bilingualism on learning to read English: Evidence from the contrast between Urdu-English bilingual and English monolingual children. *Journal of Research in Reading, 24,* 113–134.

Oller, D. K., & Eilers, R. E. (Eds.). (2002). *Language and literacy in bilingual children.* Clevedon, England: Multilingual Matters.

Ricciardelli, L. A. (1992). Bilingualism and cognitive development in relation to threshold theory. *Journal of Psycholinguistic Research, 21,* 301–316.

Rickard Liow, S. (1999). Reading skill development in bilingual Singaporean children. In M. Harris & G. Hatano (Eds.), *Learning to read and write: A cross-linguistic perspective* (pp. 196–213). Cambridge, England: Cambridge University Press.

Rickard Liow, S., & Poon, K. K. L. (1998). Phonological awareness in multilingual Chinese children. *Applied Psycholinguistics, 19,* 339–362.

Romaine, S. (1995). *Bilingualism* (2nd ed.). Oxford, England: Blackwell.

Swanson, H. L., Sáez, L., Gerber, M., & Leafstedt, J. (2004). Literacy and cognitive functioning in bilingual and nonbilingual children at or not at risk for reading disabilities. *Journal of Educational Psychology, 96,* 3–18.

Wade-Woolley, L., & Geva, E. (2000). Processing novel phonemic contrasts in the acquisition of L2 word reading. *Scientific Studies of Reading, 4,* 295–311.

Wu, X., Li, W., & Anderson, R. C. (1999). Reading instruction in China. *Journal of Curriculum Studies, 31,* 571–586.

Yelland, G. W., Pollard, J., & Mercuri, A. (1993). The metalinguistic benefits of limited contact with a second language. *Applied Psycholinguistics, 14,* 423–444.

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