Applied Psycholinguistics **24** (2003), 27–44
Printed in the United States of America
DOI: 10.1017.S014271640300002X

Developing phonological awareness: Is there a bilingual advantage?

ELLEN BIALYSTOK, SHILPI MAJUMDER,
and MICHELLE M. MARTIN
York University

ADDRESS FOR CORRESPONDENCE
Ellen Bialystok, 4700 Keele Street, Toronto, Ontario, M3J 1P3 Canada. E-mail: ellenb@yorku.ca

ABSTRACT
Three studies are reported that examine the development of phonological awareness in monolingual and bilingual children between kindergarten and Grade 2. In the first study, monolingual and bilingual children performed equally well on a complex task requiring phoneme substitution. The second study replicated these results and demonstrated a significant role for the language of literacy instruction. The third study extended the research by including two groups of bilingual children and a range of phonological awareness and reading tasks. Spanish–English bilinguals performed better than English-speaking monolinguals on a phoneme segmentation task, but Chinese–English bilinguals performed worse. Other measures of phonological awareness did not differ among the three groups. The results are discussed in terms of a limit on the effect that bilingualism exerts on metalinguistic development.

The possibility that bilingualism may have facilitating effects on children's metalinguistic development was first proposed by Vygotsky (1962). Research in the past 30 years has explored this idea, usually assessing children's word awareness and syntactic awareness. The results have been mixed, but the majority of published studies have reported an advantage for bilingual children (Ben–Zeev, 1977; Bialystok, 1986, 1988; Bowey, 1988; Cummins, 1978; Edwards & Christophersen, 1988; Galambos & Goldin–Meadow, 1990; Galambos & Hakuta, 1988; Smith & Tager–Flusberg, 1982; Yelland et al., 1993). It would be particularly important if such an advantage could be found for phonological awareness. Unlike other aspects of metalinguistic ability, phonological awareness is centrally implicated in children's acquisition of literacy, especially for alphabetic scripts (Bryant & Goswami, 1987; Liberman et al., 1977; Morais et al., 1986; Perfetti et al., 1988; Schneider et al., 1997; Wagner et al., 1994, 1997). If bilingual children acquire concepts of sublexical phonemic structure more easily than monolingual children do, then they may also have an advantage in learning to read. Therefore, knowing whether there are bilingual advantages in the development of phonological awareness will contribute to our understanding of metalinguistic ability, bilingual influences on cognitive development, and early literacy acquisition. The purpose of the present studies was to examine the effect of bilingualism on the development of this skill that is essential to the acquisition of literacy, although literacy itself was not directly investigated.

Demonstrating a bilingual advantage in the development of phonological awareness for bilingual children requires assuring the generality of the claim. If bilinguals speaking different languages perform differently from each other, then the source of performance variation may be language-specific effects on this development and not bilingualism per se. Similarly, if factors such as age, length of instruction, or language of schooling can account for differences in performance, then these differences cannot be attributed to bilingualism. Finally, if different phonological awareness tasks produce different between group effects, then it cannot be concluded that there is necessarily an advantage to being bilingual but rather that there is an interaction between bilingualism and specific tasks. All of these issues must be addressed when identifying the effects of bilingualism on metalinguistic awareness.

Only a small number of studies have examined the relation between bilingualism and the development of phonological awareness. Rubin and Turner (1989) compared the phonological awareness of English-speaking first-grade children in English programs to those in French immersion programs. Children in the immersion group, who were only minimally bilingual, performed better than their peers in the English program.

Using a similar population, Bruck and Genesee (1995) compared monolingual English-speaking children with other Anglophone children attending French schools. Thus, French was a second language for the bilingual children and their only exposure to this language was at school. The children were studied longitudinally from kindergarten to first grade on a variety of tasks. An advantage was found for the children in the French programs on onset-rime segmentation in kindergarten, but it disappeared in Grade 1. In first grade, there was an advantage for the monolingual children on a phoneme counting task and a bilingual advantage on a syllable counting task. The authors proposed different explanations for each of these results. They attributed the bilingual advantage in syllable awareness to the structure of French phonology, which makes the syllable more salient than it is in English. The monolingual advantage in phoneme awareness was ascribed to differences in reading instruction, which provided only the monolingual children with phonological training. They concluded that "bilingualism has selective rather than universal effects on the development of phonological awareness" (p. 319). Their results suggest that the specificity of the languages learned and the instruction received is more responsible for differences in phonemic awareness than is bilingualism.

Yelland et al. (1993) also studied children who were at the early stages of bilingualism. The children were in kindergarten and Grade 1; the bilingual children were native speakers of English who had limited exposure to Italian. Children were required to make judgments of the sound structure of words by determining whether simple pictures depicted an object that had a long name (polysyllabic) or a short name (monosyllabic). Like Bruck and Genesee (1995), they found an initial advantage for bilinguals that disappeared by the end of

Grade 1. They also found that the Grade 1 bilinguals maintained an advantage over monolinguals in word recognition.

Campbell and Sais (1995) compared 5-year-old bilingual children with monolingual children on several phonological tasks. The bilingual children were attending schools where both Italian and English were spoken, although they were not immersion schools. At least one parent was a native speaker of Italian, but English was used at home with parents and siblings. The level of proficiency in Italian varied among participants and was neither controlled nor measured. The monolingual children attended English schools and spoke English at home, but several of these children had at least one parent who was not a native speaker of English. The participants completed four tasks: detecting a mismatch in the initial sound of a set of words, detecting a mismatch in meaning, deleting morphemes from words, and identifying letters. The bilingual children scored higher than the monolinguals on the first three tasks but the two groups were the same on the letter identification task, a pattern that Campbell and Sais interpreted as indicating an advantage in metalinguistic but not linguistic knowledge. However, these tasks make limited demands on phonological awareness and the children were only tested in preschool. In the studies described above, preschool advantages disappeared in first grade. Additionally, the authors noted that the syllabic and phonological structure of Italian is more systematic than in English. Therefore, the advanced development of these skills by the bilingual children may be due to learning Italian rather than reflecting a general bilingual advantage, as was suggested in the study by Bruck and Genesee (1995).

These studies do not resolve the question about whether bilingualism influences children's acquisition of phonological awareness. The children were only beginning to become bilingual and group differences usually disappeared by first grade, when literacy instruction was introduced. Moreover, it seems some phonological skills are learned earlier by virtue of learning a specific language that emphasizes those structures rather than being a general effect of bilingualism. Finally, the range of different tasks used across the studies tended to produce differing results.

We report three studies that attempt to isolate the role of bilingualism in children's development of phonological awareness. Although the research does not explicitly address the acquisition of literacy in these children, phonological awareness and alphabetic literacy are intricately linked (e.g., review in Adams, 1990), so the discussion of phonological abilities must inevitably include some discussion of the literacy context. Cross-sectional designs examined monolingual and bilingual children at three points in literacy acquisition: just prior to literacy instruction (kindergarten), during the early stages of literacy instruction (Grade 1), and in the early stages of reading (Grade 2).

STUDY 1

One factor that affects the difficulty of a phonological awareness task is its demand on working memory. In the first study, a complex task was adapted to manipulate memory demands by providing cues to the solution. The intention was to disentangle working memory demands from phonological awareness demands and observe whether bilingualism affects children's ability to solve these problems.

Method

Participants. There were 72 children in the study, half of whom were English–French bilinguals. The bilingual children lived in a middle-class suburb of a large English-speaking city and attended French-language schools. These are schools designed for the French-speaking community within the English majority. The school curriculum is presented in French, and English is introduced as a subject in Grade 3. The children speak French at school and often at home to at least one parent, but because they live in English neighborhoods, watch English television, play with English-speaking friends, and attend extracurricular activities (such as sports, dancing lessons, etc.), they are also fluent in English. Thus, these children used both languages every day in their normal routines: they required French fluency to function in a French-medium school and English fluency to live in an English-speaking community.

The monolingual children were attending public schools in the same middle-class suburb as the bilingual children. An equal number of children in each language group were in kindergarten (mean age monolingual = 5;8, bilingual = 5;5), Grade 1 (mean age monolingual = 6;2, bilingual = 6;3), and Grade 2 (mean age monolingual = 7;3, bilingual = 7;9).

Tasks

DIGIT SPAN. The Forward Digit Span task from the Wechsler Intelligence Scale for Children–Revised (Wechsler, 1974) was used to assess working memory. Children were required to repeat increasingly long strings of random digits. Testing terminated when two errors were made at the same string length, and the child's score was the number of digits in the last correct series.

PHONEME SUBSTITUTION TASK. This task, involving the segmentation and manipulation of sounds, is similar to the substitute initial consonant task developed by Stanovich, Cunningham, and Cramer (1984) for use with kindergarten children. There were three conditions based on the presence of different cues to reduce memory demands.

Children were asked to replace the initial sound in one word with the initial sound from another word to create a new word. In the no-cue condition, children were told, "Take away the first sound from the word *cat*, and put in the first sound from the word *mop*," producing the response *mat*. In the sound condition, the initial phonemes were already segmented, for example, "Take away the /k/ sound from *cat*, and put in the /m/ sound from *mop*." In the picture condition, children were shown pictures of the two words *cat* and *mop* to reduce the need to hold them in working memory while they heard the problem.

The task began with several training items including full feedback. The three

https://doi.org/10.1017/S014271640300002X Published online by Cambridge University Press

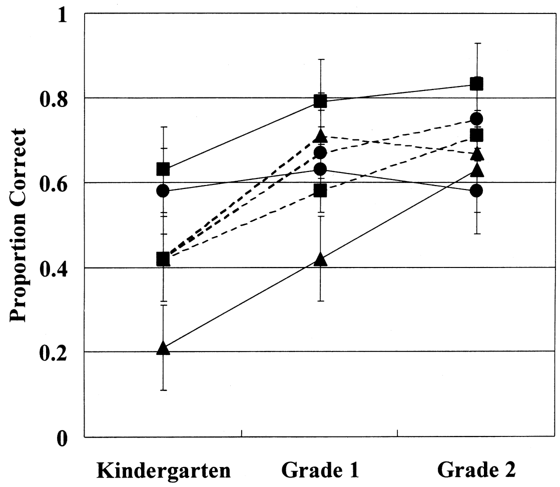

Figure 1. The proportion correct on the phoneme manipulation task by group, grade, and condition in Study 1. (■) Sound, (●) picture, and (▲) no cue for (—) monolinguals and (---) bilinguals.

conditions were interspersed in the test items. They were four word pairs in each cue condition, for a total of 12 items, presented in random order. The word pairs were assigned to different cue conditions for different children so that there would be no effects of specific items. For simplicity of comparisons across groups, scores were converted to proportion correct.

Results

A two-way analysis of variance (ANOVA) for grade (3) and language group (2) on the digit span scores showed a difference between the monolinguals (M = 5.86, SD = 1.04) and bilinguals (M = 5.08, SD = 1.27), F (1, 66) = 8.04, $p <$ .006. There was no effect of grade and no interaction.

The phoneme substitution task was analyzed in a three-way ANOVA for condition (3), grade (3), and group (2). There was a condition effect, F (2, 67) = 5.25, $p < .007$, and linear contrasts showed that this was caused by the no-cue condition being more difficult than the other two conditions ($p < .05$). There was a grade effect, F (2, 68) = 4.11, $p < .02$, with linear contrasts indicating that the Grade 1 and 2 children performed better than those in kindergarten ($p <$ .05). An interaction of condition and group, F (2, 67) = 5.98, $p < .004$, revealed condition differences for the monolinguals, F (2, 32) = 9.05, $p < .0008$, but not for the bilinguals ($F < 1$). Scheffé contrasts (all $p < .05$) showed an advantage for the monolingual children in the sound condition (monolinguals M = .75, SD = .30; bilinguals M = .57, SD = .43) but a bilingual advantage in the no-cue condition (monolinguals M = .42, SD = .42; bilinguals M = .58, SD = .44). These results are shown in Figure 1.

The manipulation of working memory demands in the three conditions differentially affected the two language groups, indicating that each group used these cues differently. Correlations between the digit span score and performance on each of the conditions of the phoneme substitution task indicated different patterns for the two groups. For the monolinguals, there was only a significant correlation between performance on the no-cue condition and the working memory measure ($r = .36$, $p < .05$), but for the bilinguals, digit span performance was significantly correlated with the sound condition ($r = .51$, $p < .005$), the picture condition ($r = .56$, $p < .001$), and the no-cue condition ($r = .45$, $p < .05$). These patterns suggest possible group differences in strategic approaches to the problem regarding the role of working memory demands.

Discussion

Between kindergarten and Grade 2, children acquired the ability to solve a difficult problem in phonological awareness. This replicates the results of Stanovich et al. (1984) demonstrating that children could solve problems of this type in kindergarten. The groups may have approached the problem differently. The bilinguals appeared to ignore the memory cues and solved all the versions to the same level, outperforming the monolinguals on the no-cue items but not profiting from the built-in clues in the other two conditions. Yet, in spite of possible strategic differences that made some conditions easier or harder, there was no overall difference between the two language groups in their ability to solve this problem. In addition, differences in initial levels of working memory, as measured by digit span, mean that the results may indicate more about the role of working memory than the role of bilingualism. The tentative conclusion, then, is that command of two spoken languages by preschool children gives them no special access to the sound structure that is involved in the solution to this phonological awareness task. At best, the groups approached the problem with different strategies that sometimes benefited one or the other group but produced comparable overall performance.

Two features of the design undermine a strong conclusion. First, the monolingual children scored better than the bilinguals on the digit span test of working memory, perhaps giving them an advantage in solving these problems. Second, the bilingual children were being educated in French but were tested in English. This mismatch in the language of literacy instruction and the language of testing may also account for some of the differences between the groups. The next study addressed these issues.

STUDY 2

Two changes were made to the procedures used in Study 1. First, a second test of working memory was added to provide a more complete assessment. Second, the French–English bilingual children were tested in both languages, both to compare proficiency in their two languages and to assess the importance of the language of testing and the language of schooling.

https://doi.org/10.1017/S014271640300002X Published online by Cambridge University Press

Method

Participants. Seventy-five children (39 English monolinguals, 36 French–English bilinguals) participated in the study. The children were in kindergarten (mean age monolingual = 6;0, bilingual = 5;9), grade 1 (mean age monolingual = 7;0, bilingual = 6;10) and grade 2 (mean age monolingual = 7;10, bilingual = 7;8). For the monolingual and bilingual groups there were 13 and 12 children per grade, respectively. The monolingual children were attending child-care programs in middle-class suburbs of a large city. The bilingual children were attending one of the French schools involved in Study 1 and were fluent in both French and English. Again, these children were necessarily bilingual because they used French in school and English at home and in the community, both on a daily basis. All the bilingual children were tested in both languages and easily understood the instructions and tasks in both languages.

Tasks. In addition to the digit span and phoneme substitution tasks used in Study 1, another measure of working memory was included called the picture recall task. Children were shown a large album in which each page contained 12 pictures. A puppet pointed to a number of the pictures on the page, beginning with two and increasing that number in each subsequent page by one picture. If children made an error, they were given another chance on the next page using the same number of pictures. Testing ended when they were incorrect on two consecutive pages in which they had to indicate the same number of pictures. For each page, the children pointed to the pictures that the puppet had indicated. Unlike the digit span task, the order in which they pointed to the pictures was unimportant. Their score was the number of pictures correctly recalled across all pages viewed.

The French version of the phoneme substitution was designed to match the English version. All the words were familiar one-syllable names for common objects. The bilingual children were tested in each language in different sessions separated by about 1 week. The tasks were presented in the following order: picture recall, phoneme substitution, and digit span.

Results

A two-way ANOVA for grade and group was conducted on the results of each of the memory tests. There were grade effects for both digit span, F (2, 69) = 4.52, $p < .01$, and picture recall, F (2, 69) = 3.69, $p < .03$, but there was no difference between groups and no interactions. Scheffé tests indicated that the grade effects were caused by differences between the children in kindergarten and those in Grade 2. These age differences reflect commonly found improvements in working memory between the ages of 4 and 7 (e.g., Diamond & Taylor, 1996).

Scores from the phoneme substitution task in English were analyzed in a three-way ANOVA for condition (3), grade (3), and group (2). There was an effect of grade, F (2, 69) = 23.51, $p < .0001$, with the two older groups outperforming the kindergarten children (Scheffé, $p < .05$), replicating the pattern in

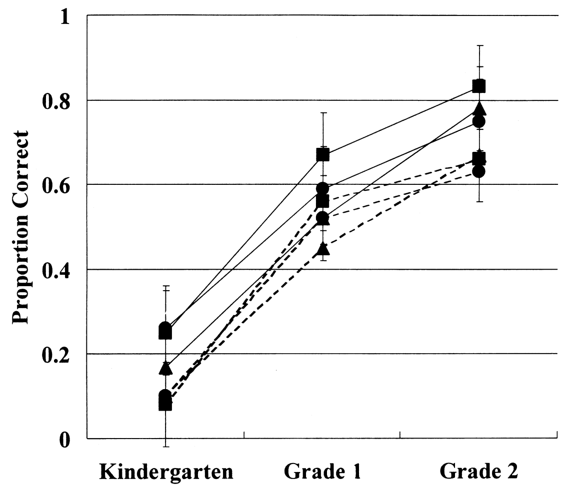

Figure 2. The proportion correct on the phoneme manipulation task by group, grade, and condition in Study 2. (■) Sound, (●) picture, and (▲) no cue for (—) monolinguals and (---) bilinguals.

Study 1. There was no effect of condition, and the group effect approached significance, F (1, 69) = 3.42, p = .07. The conditions were analyzed individually to examine potential group differences for the specific conditions, as was found in the first study. There was an effect of group for performance in the sound condition, F (1, 69) = 5.90, p < .02, with the monolinguals (M = .58, SD = .37) outperforming the bilinguals (M = .41, SD = .37), replicating the results of Study 1. No other group or interaction effects were significant. These results are displayed in Figure 2.

The scores of the bilinguals were examined by a three-way ANOVA for condition (3), grade (3), and language (2). There were effects for grade, F (2, 33) = 15.88, p < .0001, and language, F (1, 33) = 7.29, p < .01. French scores were higher than English scores, and again kindergarten children scored lower than those in the other two grades. These results are shown in Figure 3.

A two-way ANOVA for condition (3) and group (2) compared performance in the language of schooling. Thus, the monolingual English scores were compared to the bilingual French scores. There was no effect of condition or group and no interaction between them. Hence, when performance is compared between the groups, keeping the language of literacy instruction constant, there is no difference in their performance on this phonological awareness task.

As in the first study, correlations were carried out on the relationship between performance on each of the sound conditions and the working memory measures. For the bilinguals, significant correlations were found between the digit span score and the sound condition (r = .36, p < .05), the picture condition (r = .43, p < .01), and the no-cue condition (r = .40, p < .05). Furthermore, the picture memory task correlated with the scores on the sound condition (r = .33,

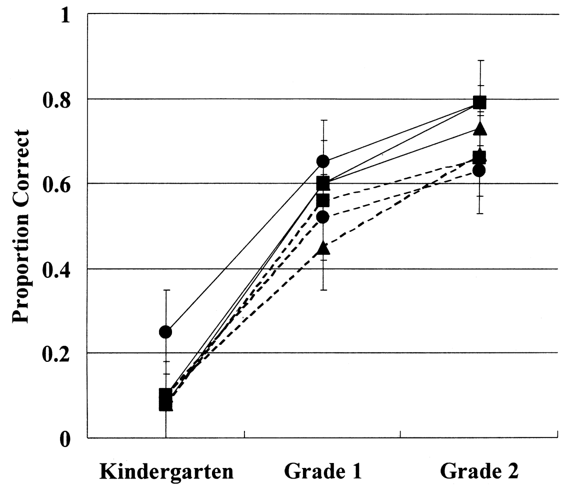

Figure 3. The proportion correct on the phoneme manipulation task by bilingual children in their two languages in Study 2. (■) Sound, (●) picture, and (▲) no cue for (—) monolinguals and (---) bilinguals.

$p < .05$). The same pattern was found for the monolingual group, with significant correlations between the digit span and the sound condition ($r = .58$, $p < .001$), the picture condition ($r = .53$, $p < .001$), and the no-cue condition ($r = .56$, $p < .001$).

Discussion

All the children were comparable on two assessments of working memory, yet there was no overall effect of bilingualism in the phoneme substitution task. Unlike Study 1, the working memory measure was related to performance on the phonological awareness task for all the children, not just the bilinguals. There is no apparent reason why the monolingual children in Study 1 failed to show this relation in two of the conditions.

The monolingual advantage in the sound condition found in Study 1 was replicated for testing in English. However, this effect disappeared in cases where the language in which phonological awareness was tested corresponded to the language in which literacy instruction was taking place. Controlling for the language of literacy instruction, the performance of the monolinguals in English and the bilinguals in French was identical. Differences in the sound condition, therefore, are probably attributable to the experience of learning to read and the effects of that experience remain specific to the language of instruction. The sound analysis required for this condition may resemble the type of phonemic analysis undertaken in their school activities. Again replicating Study 1, the kindergarten children were at a disadvantage relative to the other two grades, an effect consistent with the importance of literacy instruction in the development of phonological awareness.

STUDY 3

In the previous two studies, bilingualism did not influence children's ability to solve the phoneme substitution task. However, different phonological awareness tasks make different cognitive demands (e.g., Adams, 1990; Yopp, 1988) and have different relationships with early reading (e.g., Høien et al., 1995; Wagner et al., 1994). Therefore, bilingualism may affect the acquisition of some aspects of phonological awareness and not others. The third study compared the performance of monolingual children with two groups of bilingual children solving three problems in phonological awareness. In addition, children were tested for their ability to decode simple words and nonwords.

Method

Participants. The participants were 89 children (43 males, 46 females) in Grades 1 and 2 who belonged to one of three language groups: monolingual English, bilingual Chinese–English, and bilingual Spanish–English. There were 16 monolingual children in Grade 1 (mean age = 6;7 years) and 17 in Grade 2 (mean age = 7;5 years); 16 Chinese bilingual children in Grade 1 (mean age = 6;6 years) and 15 in Grade 2 (mean age = 7;6 years); and 12 Spanish bilingual children in Grade 1 (mean age = 6;7 years) and 13 in Grade 2 (mean age = 7;4 years).

The children were recruited from schools and community language programs in a multicultural metropolitan area. The monolingual children had little or no exposure to any language other than English. Parents of the bilingual children completed a questionnaire inquiring about language use patterns in the home in order to get a rough assessment of language fluency. All the bilingual children were regularly exposed to Chinese or Spanish at home. For both the Chinese and Spanish bilinguals, English was the language of school and the environment and Chinese or Spanish was the language of the family and cultural community. For the Chinese bilingual families, approximately half of the participants indicated that they were Cantonese speaking and the remainder were either Mandarin speaking or did not identify which Chinese language they spoke. All the children in the bilingual groups lived in homes where the language of interaction between the parents and the parents and children was either exclusively Spanish or Chinese or a mixture of one of those languages with English. No parents indicated that English was the primary language of communication. However, 15 of the Chinese children and 15 of the Spanish children were described as watching television and videos only in English. Finally, 19 of the Chinese children and 8 of the Spanish children were read stories at home only in English; the remaining 12 Chinese children and 17 Spanish children were read stories in both languages.

Design and tasks. Five tasks were administered over two sessions. The first session consisted of the Peabody Picture Vocabulary Test–Revised (PPVT-R, Dunn & Dunn, 1981), the sound–meaning task, and the phoneme segmentation

https://doi.org/10.1017/S014271640300002X Published online by Cambridge University Press

task; the second session included the phoneme substitution task and the word identification and the word attack subtests of the Woodcock Reading Mastery Tests (Woodcock, 1987). There was about 1 week between testing sessions.

PPVT-R. The PPVT-R is a standardized test of receptive vocabulary. It was used as a measure of English language fluency as well as a measure of general verbal ability. As indicated by the parent questionnaire, the bilingual children were regularly exposed to either Chinese or Spanish in the home, and many parents indicated that these languages were their own first languages. Therefore, children's proficiency in English was one way to provide some assessment of the degree to which the children were bilingual. In the test, children choose one of four pictures to correspond to a word spoken by the experimenter. The items are graduated for difficulty; children begin at a point established for their age and continue until they make six errors in eight consecutive responses.

SOUND–MEANING TASK. A puppet gave the child a target word and asked which of two choices matched on either sound or meaning. For example, in the sound condition, the question was: "Which word sounds something like *dog: log* or *puppy*?" and in the meaning condition: "Which word means something like *dog: log* or *puppy*?" Following practice items with feedback, the test consisted of 16 items randomly interspersing eight sound questions and eight meaning questions. Two versions of the task were created by reversing the pairings of words with the sound and meaning questions. Half of the children received each version.

PHONEME SEGMENTATION TASK. Children were introduced to The Count, a *Sesame Street* character who likes to count things, and told that today he would be counting the number of sounds in words. The experimenter gave the child a word and the instruction to "spread out the sounds" and then count the sounds by using a set of poker chips. Several practice items with feedback were given. The test included 16 words, and there was a maximum of five phonemes in each word. There were 10 one-syllable words and 6 two-syllable words. Separate scores were recorded for the segmentation and counting steps.

PHONEME SUBSTITUTION TASK. This task was adapted from the sound condition used in the previous two studies but included phoneme replacements in the first, middle, or last phoneme of the target word. There were 15 test items, 5 each based on first, middle, and final sounds.

WORD IDENTIFICATION AND WORD ATTACK TESTS. These tasks are part of the Basic Skills Cluster of the Woodcock Reading Mastery Tests. The scores of these subtests combined provide a measure of overall decoding ability and may be examined separately from the entire battery (Woodcock, 1987). For each subtest, children read lists of words and continue until they make six consecutive errors. The Word Identification test presents real words starting at children's grade level, and the Word Attack test presents pseudowords.

Results

The PPVT-R scores were analyzed with a two-way ANOVA for grade (2) and group (3). There was an effect of group, F (2, 83) = 5.33, p < .006. Post hoc Tukey tests revealed that the monolingual children (M = 108.00, SD = 13.74) outscored the Chinese–English bilinguals (M = 97.06, SD = 11.32) and that the Spanish–English bilinguals did not differ from either group (M = 102.80, SD = 14.69).

Scores of the sound–meaning task were examined in a three-way ANOVA for item (sound, meaning), grade, and group. There was only an effect of grade, F (1, 83) = 21.34, p < .0001, and children in Grade 2 (M = .80, SD = .20) scored higher than those in Grade 1 (M = .64, SD = .26).

The segmentation task, which was analyzed by a two-way ANOVA for grade and group, revealed an effect of group, F (2, 83) = 15.69, p < .001. A Duncan's multiple range test of means indicated that the three groups were different from each other (p < .05), and the Spanish–English bilinguals performed best (M = .59, SD = .20), followed by the monolinguals (M = .48, SD = .22) and the Chinese–English bilinguals (M = .30, SD = .16). Because this order is similar to that found for the PPVT-R, a correlation between these task was computed to determine if they were related. The correlation was not significant (r = .11, *ns*). Therefore, the segmentation task did not simply measure vocabulary knowledge.

The phoneme substitution task was subjected to a three-way repeated measures ANOVA for phoneme position (first, last, middle), grade, and group. Again, there was no effect of group but there was an effect of grade, F (1, 83) = 26.44, p < .0001, the children in Grade 2 performing better than children in Grade 1. There was also an effect of phoneme position, F (2, 166) = 10.17, p < .0001. Linear contrasts showed that it was easier to replace the first phoneme than those in the other two positions (p < . 01). The results are plotted in Figure 4.

The Word Identification (words) and Word Attack (pseudowords) reading tasks were analyzed by means of a three-way repeated measures ANOVA for task (words, pseudowords), grade, and group on the standardized scores. There was an effect of task, F (1, 83) = 63.58, p < .001, showing that overall, children performed better on the Word Identification task (M = 118.7, SD = 16.4) than on the Word Attack task (M = 160.0, SD = 20.3). There were no effects of grade or language group on either of these tasks individually. These scores were then combined to form a basic skills score. The basic skills standard scores were analyzed by a two-way ANOVA for grade and group. No effects of grade or language group were found. The mean standard and stanine scores are presented in Table 1.

Finally, the correlation between the reading scores and each of the phonological awareness tasks was computed. The only phonological awareness measure that correlated with the reading scores was phoneme substitution. This correlation was found for Word Identification (r = .46, p < .001), Word Attack (r = .35, p < .001), and the basic skills score (r = .39, p < .001). Correlations were also performed by language group. For the monolingual group, the phoneme substitution score correlated with Word Identification (r = .57, p < .001) and

https://doi.org/10.1017/S014271640300002X Published online by Cambridge University Press

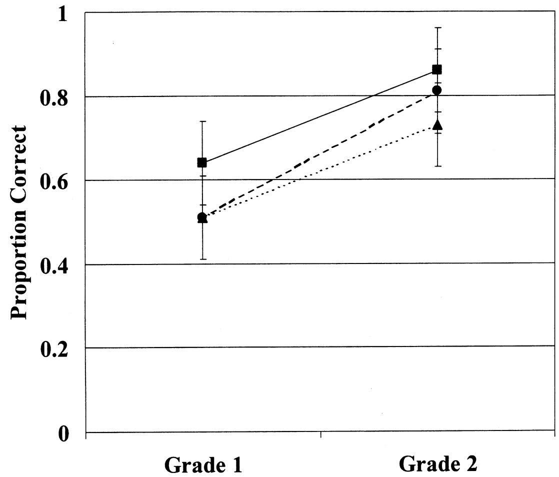

Figure 4. The proportion correct in the phoneme substitution task by position and grade in Study 3 for (■) first, (●) middle, and (▲) last.

Table 1. *Means and standard deviations of standard and stanine scores in reading tasks by grade and language group*

		Grade					
		1			2		
	Language Group	Monolingual English (*n* = 16)	Bilingual Chinese (*n* = 16)	Bilingual Spanish (*n* = 12)	Monolingual English (*n* = 17)	Bilingual Chinese (*n* = 15)	Bilingual Spanish (*n* = 13)
Word identification	Standard	116.4 (15.3)	123.2 (14.3)	115.0 (22.1)	120.8 (15.8)	121.1 (11.8)	114.0 (19.6)
	Stanine	6.8 (2.0)	7.8 (1.5)	6.4 (1.8)	7.5 (1.7)	7.6 (1.2)	6.5 (2.3)
Word attack	Standard	106.0 (15.4)	110.4 (14.4)	96.4 (31.4)	106.4 (21.4)	109.5 (13.2)	104.9 (24.6)
	Stanine	5.7 (1.9)	6.3 (1.9)	4.5 (2.5)	5.9 (2.5)	6.2 (1.8)	5.8 (2.3)
Basic skills	Standard	114.4 (14.6)	121.8 (15.2)	109.7 (23.5)	113.4 (15.6)	116.0 (12.7)	110.5 (21.6)
	Stanine	6.6 (1.8)	7.6 (1.7)	5.9 (2.0)	6.8 (2.0)	6.9 (1.5)	6.1 (2.5)

https://doi.org/10.1017/S014271640300002X Published online by Cambridge University Press

with the basic skills score ($r = .47$, $p <.01$) and the sound–meaning score correlated with Word Identification ($r = .43$, $p < .01$). For the Chinese bilingual group, the phoneme substitution score correlated with Word Identification ($r = .39$, $p < .05$) and with Word Attack ($r = .40$, $p < .05$). For the Spanish bilingual group, the phoneme substitution score correlated with Word Identification ($r = .46$, $p < .05$), Word Attack ($r = .45$, $p < .05$), and the basic skills score ($r = .45$, $p < .03$). Hence, phoneme substitution did not differ among children in the three groups and in all cases was related to the level of performance on the reading tasks.

Discussion

Lower performance by bilinguals on PPVT-R is common (Ben–Zeev, 1977; Bialystok, 1988; Merriman & Kutlesic, 1993; Rosenblum & Pinker, 1983; Umbel, Pearson, Fernández, & Oller, 1992) and should not be overinterpreted. Furthermore, it was not related to success on the only task for which the groups differed, namely, phoneme segmentation. Performance on the sound–meaning and phoneme substitution tasks improved with age, but there were no differences between the groups. Although the phoneme substitution was given in the sound condition, there was no monolingual advantage as in the previous studies. However, the task was presented in English, which was the language of literacy instruction for all the children. In the previous two studies, group differences in this condition emerged only when children were tested in a different language from that in which they were learning to read. In this study, all children were equivalent in this way and they performed equivalently on the sound condition task.

The segmentation task requires understanding the individual phonemic segments of words but is computationally simpler than the phoneme substitution task (which requires both isolating and manipulating the segments) and more complex than the sound–meaning task (which does not even require isolating these segments). All three groups were different in their ability to solve this segmentation problem, the most proficient being the Spanish–English bilinguals. The Chinese–English bilinguals, in contrast, had the most difficulty with this task, so the factor underlying the group differences in performance cannot simply be bilingualism.

There are two possible reasons for the Spanish–English advantage. First, the sound structures of English and Spanish are more similar than are those of English and Chinese. The consonant–vowel alternation is at least familiar for the first two languages in a way that the phonological and tonal structure of Chinese is not. Thus, some language pairs may be more conducive to the discovery of phonological structure than others, even when the actual sounds in the two languages are different.

Second, Spanish itself may provide an advantage. Borzone de Manrique and Signorini (1994) reported that skilled and less skilled Spanish-speaking readers performed the same on a phoneme segmentation task. They attributed this result to the simple phonetic structure of the Spanish language and claimed that it promoted early access to phonological awareness. The simple phonetic structure of Spanish may also transfer into the children's reading of English words. Jiménez, García and Pearson (1995) compared reading processes and strategies of three Spanish–English bilingual children varying in their levels of reading proficiency. Their findings showed that high levels of reading proficiency in the native language lead to proficient reading in the second language. Although this was an exploratory study with very few subjects, the implication is that a proficient bilingual reader may be able to transfer reading acquisition skills across languages.

In the Borzone de Manrique and Signorini (1994) study, early access to phonological awareness did not necessarily translate into successful reading. Similarly, in the present study, different levels of performance in the segmentation task did not translate into differences in reading levels for the three groups and were not correlated with success in the reading tasks. The phoneme substitution task was related to reading in all the language groups. However, this task was not influenced by the children's language experience. Hence, the phonological awareness task most predictive of reading in this study was unaffected by bilingualism, precluding the possibility that bilingualism influences reading ability, at least through this route of phonological awareness. These results fail to support a role for bilingualism in developing phonological awareness, although knowledge of a language with similar phonetic structures may indeed be an advantage.

GENERAL DISCUSSION

Research aimed at determining how bilingualism influences children's developing cognitive and language competence has frequently produced inconsistent results. Although negative results are not usually noteworthy, the absence of reliable effects in this case helps to resolve an important problem: do bilingual children develop phonological awareness more easily than monolinguals as they seem to for other metalinguistic skills? The answer from these three studies is that they do not. No clear and consistent effect of bilingualism could be extracted from the results of the acquisition of phonological awareness by different groups of children assessed by different tasks.

The only task in the three studies that produced reliable group differences was phoneme segmentation. Even here, however, the effect was restricted to Spanish–English bilinguals, ruling out a conclusion about a general bilingual advantage. Other factors are more significant than bilingualism and overrule whatever potential effect might emerge from being bilingual. Further, these factors (elaborated below) may help to explain disparities between our results and those previously reported in the literature.

One factor is the language in which literacy instruction occurs. Not only was performance higher if testing was in the language of literacy instruction, but also group differences disappeared when the language of testing was the same as the language of literacy instruction. Another factor may be level of language proficiency in each language and possibly the structural relation between the two languages. In most previous studies, children were only marginally bilingual; our attempt was to recruit children who were fully competent in both their languages. Nonetheless, the bilingual groups, and to some extent the individual bilingual children, were asymmetric in their proficiency. The Chinese bilinguals in Study 3 may have struggled because of somewhat poorer English than the other two groups, just as the Spanish bilinguals may have benefitted from language contrasts. These linguistic descriptions produce a different kind of explanation from that based on the effect of bilingualism and need to be explored.

Finally, the tasks themselves contribute to children's level of performance and potentially interact with the experiences of the different groups. The only task for which group differences emerged in the present studies, phonemic segmentation, involves moderate cognitive demands. It is possible that children's success in solving more difficult problems, such as phoneme substitution, is determined primarily by their level of cognitive functioning. Simpler tasks, such as the sound–meaning problem, may be insufficiently challenging to allow any metalinguistic differences between the groups to reveal themselves.

In sum, over a series of three studies, children who fluently spoke English and one other language did not consistently solve a set of phonological awareness tasks better than monolingual children did. The tasks assessed different aspects of phonological awareness and recruited different cognitive demands for their solutions. Only a phoneme segmentation task was able to separate the groups, but no general facilitation of bilingualism was found. Furthermore, the differences also depended on the type of phonological task administered, again limiting the generalizability of claims relating bilingualism to the development of phonological awareness. These results place an important limit on the attempt to argue that bilingualism alters children's development of metalinguistic awareness. For phonological awareness, at least, this is not the case.

These results point to an area of metalinguistic awareness where bilingualism in itself may not be an advantage, although being bilingual in specific languages may be. Because phonological awareness is a precursor to reading, children who speak a second language with similar phonological structure and alphabetic orthographic system may have some advantage when learning to read in English, whereas those children who speak a second language that is phonologically and orthographically different may require additional help in understanding these concepts. Further research is required in order to make more specific predictions about the potential reading ability of children in these situations. The studies reported here indicate the need for more individualized literacy instruction depending on linguistic background.

Knowing how groups do *not* differ from each other is ultimately as important as knowing how they do differ if we are to understand the nature of language acquisition and the influence of bilingualism in the cognitive and linguistic development of young children.

ACKNOWLEDGMENTS
This research was funded by a National Sciences and Engineering Research Council (Canada) grant (A2559) to the first author. We are grateful to Judith Codd, Jane Herman, Heather Jenkin, and Anita Shankaran who assisted with the research.

REFERENCES

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

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

Bialystok, E. (1986). Factors in the growth of linguistic awareness. *Child Development, 57,* 498–510.

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

Borzone de Manrique, A. M., & Signorini, A. (1994). Phonological awareness, spelling, and reading abilities in Spanish-speaking children. *British Journal of Educational Psychology, 64,* 429–439.

Bowey, J. A. (1988). *Metalinguistic functioning in children.* Deakin University, Victoria, Australia.

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

Bryant, P. E., & Goswami, U. (1987). Phonological awareness and learning to read. In J. R. Beech & A. M. Colley (Eds.), *Cognitive approaches to reading* (pp. 213–243). New York: Wiley.

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

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

Diamond, A., & Taylor, C. (1996). Development of an aspect of executive control: Development of the abilities to remember what I said and to "do as I say, not as I do." *Developmental Psychology, 29*, 315–334.

Dunn, L. M., & Dunn, L. M. (1981). *Peabody Picture Vocabulary Test–Revised.* Circle Pines, MN: American Guidance Service.

Edwards, D., & Christophersen, H. (1988). Bilingualism, literacy and meta-linguistic 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.

Høien, T., Lundberg, I., Stanovich, K. E., & Bjaalid, I. K. (1995). Components of phonological awareness. *Reading and Writing: An Interdisciplinary Journal, 7,* 171–188.

Jiménez, R. T., García, G. E., & Pearson, P. D. (1995). Three children, two languages, and strategic reading: Case studies in bilingual/monolingual reading. *American Educational Research Journal, 32,* 67–97.

Liberman, I. Y., Shankweiler, D. P., Liberman, A. M., Fowler, C., & Fischer, F. W. (1977). The structure and acquisition of reading: II. The reading process and the acquisition of the alphabetic principle. In A. S. Reber & D. L. Scarborough (Eds.), *Toward a psychology of reading* (pp. 207–225). Hillsdale, NJ: Erlbaum.

Merriman, W. E., & Kutlesic, V. (1993). Bilingual and monolingual children's use of two lexical acquisition heuristics. *Applied Psycholinguistics, 14,* 229–249.

Morais, J., Bertelson, P., Cary, L., & Alegria, J. (1986). Literacy training and speech segmentation. *Cognition, 24,* 45–64.

Perfetti, C. A., Beck, I., Bell, L. C., & Hughes, C. (1988). Phonemic knowledge and learning to read are reciprocal: A longitudinal study of first grade children. In K. E. Stanovich (Ed.), *Children's reading and the development of phonological awareness* (pp. 39–75). Detroit, MI: Wayne State University Press.

Rosenblum, T., & Pinker, S. A. (1983). Word magic revisited: Monolingual and bilingual children's understanding of the word–object relationship. *Child Development, 54,* 773–780.

Rubin, H., & Turner, A. (1989). Linguistic awareness skills in grade one children in a French immersion setting. *Reading and Writing: An Interdisciplinary Journal, 1,* 73–86.

Schneider, W., Küspert, P., Roth, E., & Visé, M. (1997). Short- and long-term effects of training phonological awareness in kindergarten: Evidence from two German studies. *Journal of Experimental Child Psychology, 66,* 311–340.

Smith, C. S., & Tager–Flusberg, H. (1982). Metalinguistic awareness and language development. *Journal of Experimental Child Psychology, 34,* 449–468.

Stanovich, K. E., Cunningham, A. E., & Cramer, B. B. (1984). Assessing phonological awareness in kindergarten children: Issues of task comparability. *Journal of Experimental Child Psychology, 38,* 175–190.

Umbel, V. M., Pearson, B. Z., Fernandez, M. C., & Oller, D. K. (1992). Measuring bilingual children's receptive vocabularies. *Child Development, 92,* 1012, 1020.

Vygotsky, L. S. (1962). *Thought and language.* Cambridge, MA: MIT Press.

Wagner, R. K., Torgesen, J. K., & Roshotte, C. A. (1994). Development of reading-related phonological processing ability: New evidence of bidirectional causality from a latent variable longitudinal study. *Developmental Psychology, 30,* 73–87.

Wagner, R. K., Torgesen, J. K., Rashotte, C. A., Hecht, S. A., Barker, T. A., Burgess, S. R., Donahue, J., & Garon, T. (1997). Changing relations between phonological abilities and word-level reading as children develop from beginning to skilled readers: A 5-year longitudinal study. *Developmental Psychology, 33,* 468–479.

Wechsler, D. A. (1974). *Wechsler Intelligence Scale for Children–Revised.* San Antonio: TX: Psychological Corporation.

Woodcock, R. W. (1987). *Woodcock Reading Mastery Tests–Revised.* Circle Pines, MN: American Guidance Service.

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

Yopp, H. K. (1988). The validity and reliability of phonemic awareness tasks. *Reading Research Quarterly, 23,* 159–177.