PHONOLOGICAL AWARENESS IN CHINESE MONOLINGUAL AND CHINESE-ENGLISH BILINGUAL CHILDREN

by

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Abstract

This thesis reports on two studies that examined the development of phonological awareness in Mandarin monolingual children and the bilingual advantages in phonological awareness in Mandarin-English bilingual children. The first study was conducted in Shanghai, China to examine the development of three levels of phonological awareness in Mandarin-speaking children (i.e., syllable awareness, onset-rime awareness, and tone awareness) from the ages of 4 to 6. The results showed that like English-speaking children, the development of phonological awareness in Mandarin progressed from an awareness of relatively large segments (e.g. syllables) to smaller ones (e.g., onset-rime). Tone awareness, as a specific phonological awareness of Chinese, was developed earlier than other levels of phonological awareness in Mandarin-speaking children, whereas onset-rime awareness was last acquired. The second study compared Mandarin-English bilingual children’s performance on phonological awareness with Mandarin monolingual children and English monolingual children. The results showed that Mandarin-English bilinguals performed better than English monolinguals on the Elision and Blending subtests of the CTOPP. Mandarin-English bilinguals also performed better than their Mandarin monolingual counterparts on all Mandarin phonological awareness tasks except for a syllable deletion task. The results from the two studies are discussed in terms of language-general vs. language-specific developmental profiles of phonological awareness as well as the effects of bilingualism on phonological awareness of both languages in bilingual children. Further clinical and educational implications of these results are also discussed.
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1 INTRODUCTION

1.1 Overview of the thesis

Phonological awareness is a set of metalinguistic skills by which children become aware of and consciously manipulate the sound structure of a language (Gombert, 1992). It is important in predicting early reading development in alphabetic languages such as English (Adams, 1990; Goswami & Bryant, 1990) and non-alphabetic languages such as Chinese (Cheng, 1992; Anderson, Li, Ku, Shu, & Wu, 2003; He, Wang, & Anderson, 2005; Chow, McBride-Chang, & Burgess, 2005). However, different languages require different levels of phonological awareness skills. Phonemic awareness is important in learning to read English (Bruck, Genesee, & Caravolas, 1997) whereas syllable awareness and onset-rime awareness are central to reading acquisition in Chinese (Huang & Hanley, 1995; McBride-Chang & Ho, 2000; Ho & Bryant, 1997a; Hu & Catts, 1998; So & Siegel, 1997; Siok & Fletcher, 2001). Therefore, it is important to discover the types of phonological awareness that young speakers of a particular language develop before investigating the significance of phonological awareness in predicting reading acquisition. Although a large body of research has investigated the development of phonological awareness in alphabetic languages (see Gombert, 1992; Gillon, 2004, for a review), the development of phonological awareness in Chinese has rarely been systematically studied. The present study attempts to address this gap in the literature by examining the development of different phonological awareness skills with Mandarin-speaking preschoolers in Mainland China.

In the last two decades, researchers have shown great interest in phonological awareness and bilingualism since it is generally believed that bilingual children have more advanced
metalinguistic awareness skills than monolingual children (Cummins, 1978; Bialystok, 1986; Yelland, Pollard, & Mercuri, 1993). The transfer of phonological awareness skills across languages in bilingual speakers has been established in previous studies (Durgunoglu, Nagy, & Hancin-Bhatt, 1993; Comeau, Cormier, Grandmaison, & Lacroix, 1999; Gottardo, Siegel, Yan, & Wade-Woolley, 2001; Chow, McBride-Chang, & Burgess, 2005). Moreover, research has shown that bilingual children outperform monolingual children on phonological awareness tasks (Bruck & Genesee, 1995; Yelland, Pollard, & Mercuri, 1993; Chen, Anderson, Li, Hao, Wu, & Shu, 2004). However, most studies have focused on examining the bilingual advantage in phonological awareness in only one of the two languages in bilingual children. The influence of bilingualism on phonological awareness in both languages has yet to be investigated more fully.

The present study aims to bridge this gap in the literature by comparing bilingual children with two groups of monolingual children who speak either of the two languages.

1.2 Phonological awareness and reading

In the early 1970s, Isabelle Liberman first proposed that learning to read an alphabetic orthography requires a reader to be aware that spoken words can be segmented into individual phonemes (sounds) which are represented by written letters; therefore, the ability to consciously map letters onto phonemes is a critical component of learning to read in an alphabetic language (Brady & Shankweiler, 1991). Since then, a large number of studies have indicated that children’s performance on phonological awareness tasks, especially at the phonemic level, is strongly associated with their reading acquisition in alphabetic languages (Adams, 1990; Brady & Shankweiler, 1991; Gough, Ehri, & Treiman, 1992). Intervention programs that enhance
children’s phonological awareness tend to facilitate beginning reading and spelling (Blachman, 1997). However, this grapheme-phoneme correspondence in an alphabetic language is not present in non-alphabetic languages such as Chinese; thus, one would think that there might not be a connection between phonological awareness and reading in Chinese.

In contrast to English, Chinese has a morphographic writing system. The basic symbols of written Chinese are characters. Each character represents both a syllable and a morpheme. Therefore, some researchers have proposed that Chinese orthography is a meaning-based script, and so morphological awareness rather than phonological awareness uniquely predicts early Chinese character recognition (McBride-Chang, Wat, Shu, Zhou, & Wagner, 2003; Shu, Wu, McBride-Chang, & Liu, 2006). However, Cheng (1992) suggested that phonological awareness does play an important role in Chinese character identification since Chinese orthography is indeed a speech-based script. More than 80% of Chinese characters are semantic-phonetic compounds, which have a semantic radical to indicate the word meaning and a phonetic radical to provide clues to the pronunciation of the character, ranging from exact homophones to analogy cues at the level of syllable or rime\(^1\) (Leong, 1986). For example, the compound character 城, meaning ‘city’, consists of the semantic radical 土, indicating ‘soil’ or ‘earth’, and

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\(^1\) 'Rime' is also spelled 'rhyme' (Gussenhoven & Jacobs, 1998). The term 'rime' is frequently used by linguists when contrasting to 'onset'; however, 'rhyme' is often used in specific tasks since it is a familiar term to educators and the public. In this thesis, we will use the term 'rime' to contrast to 'onset' in discussion and 'rhyme' in specific task.
the phonetic radical 成, which is pronounced /cheng2/ in isolation, giving the character the same pronunciation. Anderson, Li, Ku, Shu, & Wu (2003) and He, Wang, & Anderson (2005) found that Chinese children are able to use information about the pronunciation derived from the phonetic radicals to decode unfamiliar compound characters, and this analytic ability was associated with children’s performance on rhyme and tone awareness tasks. Therefore, even though learning to read Chinese does not involve the phoneme mapping process, it still requires the reader to understand the nature of the correspondence between the written script and the spoken language.

Together, the aforementioned studies (Adams, 1990; Brady & Shankweiler, 1991; Gough, Ehri, & Treiman, 1992; Blachman, 1997; Anderson, Li, Ku, Shu, & Wu, 2003; He, Wang, Anderson, 2005) suggest that the role of phonological awareness in learning to read may be universal across languages. However, the importance of a particular level of phonological awareness in reading acquisition is different in various languages (see Goswami, 1999, for a review). Treiman and Zukowski (1991) proposed that there are three main levels of phonological awareness in the analysis of most languages: syllable awareness, onset-rime awareness, and phoneme awareness. Previous studies have suggested that phonemic awareness is important in learning to read English, whereas syllable awareness may not play as major a role (Bruck, Genesee, & Caravolas, 1997). In contrast, a number of recent studies which tested Chinese-speaking children’s different levels of phonological awareness and their Chinese reading ability have found that reading acquisition in Chinese depends primarily on syllable awareness and onset-rime awareness, but not on phonemic awareness (Huang & Hanley, 1995;
McBride-Chang & Ho, 2000; Ho & Bryant, 1997a; Hu & Catts, 1998; So & Siegel, 1997; Siok & Fletcher, 2001). Thus, different orthographies may require different levels of phonological awareness.

On the other hand, different languages may facilitate the development of different levels of phonological awareness. It has been established in previous research that children who speak different languages demonstrate superiority on different phonological awareness skills (Cossu, Shankweiler, Liberman, Katz, & Tola, 1988; Bruck, Genesee, & Caravolas, 1997; Cheung, Chen, Lai, Wong, & Hills, 2001). For instance, Bruck, Genesee, and Caravolas (1997) compared performance on phoneme and syllable awareness tasks between French- and English-speaking kindergarten and first-grade children. The French-speaking children outperformed their English counterparts on syllable awareness tasks, whereas English-speaking children performed significantly better on phoneme awareness tasks. Cheung, Chen, Lai, Wong, and Hills (2001) examined the awareness of syllable, onset, rime, and coda in Cantonese- and English-speaking children by asking the child to decide which one of two stimuli sounded more similar to the target. The phonological awareness tasks were equivalent across these two languages. Cantonese-speaking children were tested in Cantonese whereas English-speaking children were examined in English. By comparing the performance of Cantonese-speaking children with that of English-speaking children, Cheung et al. (2001) discovered that the two groups performed equivalently on the syllable awareness task; however, English-speaking children develop more advanced skills in onset, rime, and coda awareness. In sum, because children may develop different phonological awareness skills in different languages and learning to read different
writing systems requires different phonological awareness skills, it is important to discover the developmental profile of phonological awareness in pre-readers of a particular language before investigating the relationship between phonological awareness and reading acquisition in that language.

1.3 Development of phonological awareness skills in English

The development of phonological awareness was first studied in alphabetic languages (Brady & Shankweiler, 1991). Treiman and Zukowski (1991) proposed that phonological awareness is represented at different levels (i.e., syllable awareness, onset-rime awareness, and phoneme awareness) and there is a hierarchy between these levels. The syllable is a relatively large unit since it consists of an onset, which is formed by the initial consonant(s), and a rime, which includes the vowel and coda consonant(s) of a syllable. Onsets and rimes can be further divided into individual phonemes. Previous research has demonstrated that in alphabetic languages such as English and Spanish, the development of phonological awareness progresses from an awareness of larger phonological units (e.g., syllables) to smaller ones (e.g., phonemes) (Treiman & Zukowski, 1991; Adams, 1990; Gorman & Gillam, 2003). Children generally first develop the ability to perceive and manipulate language at the level of syllables and then develop onset-rime awareness. Phonemic awareness is the most advanced and last acquired level of phonological awareness.

Syllable deletion tasks have been used to examine the development of syllable awareness in English (Fox & Routh, 1975; Rosner & Simon, 1971). It has been shown that English-speaking children develop the ability to delete initial or final syllables from a bisyllabic word at a
very young age. For instance, Fox & Routh (1975) found that 3-year old children achieved a 60 per cent success rate on this task and maximum performance emerged from the age of 4 onwards. However, the ability to extract a medial syllable from a word is not completely developed even by 12-year olds (Rosner & Simon, 1971).

The awareness of onsets and rimes has been examined using rhyme and onset detection tasks (Lenel & Cantor, 1981; Maclean, Bryant, & Bradley, 1987; Stanovich, Cunningham, & Cramer, 1984). Though the test procedures in these studies were different, the findings have consistently suggested that English-speaking 4-year-olds are able to detect onsets and rhymes.

Because phonemic awareness is closely related to early reading acquisition in English, various tasks such as blending and phoneme deletion have been used in previous research to study the development of phonemic awareness. Blending ability has been found to develop earlier than phoneme deletion skill (Perfetti, Beck, Bell, & Hughes, 1987; Yopp, 1988). A number of previous studies have suggested that English-speaking children are unable to manipulate phonemes until they are 5 or 6 years old (Rosner & Simon, 1971; Liberman, Shankweiler, Fischer, & Carter, 1974). Adams (1990) noted that, although children have acquired certain knowledge of phonemes before learning to read, they are likely to be unable to develop phonemic awareness spontaneously just by speaking English because their success rates on phonemic awareness tasks are still low before entering school. She proposed that reading instruction is the primary method for children to develop awareness of phonemes because children demonstrate significant improvement on phonemic awareness tasks after schooling begins. Research findings on the phonemic awareness skills of illiterate adults (Morais,
Bertelson, Cary, & Alegria, 1986; Morais, Content, Bertelson, Cary, & Kolinsky, 1988) have suggested that learning to read an alphabetic language does facilitate the development of phonemic awareness. However, other researchers suggested that the relationship between the development of phonemic awareness and reading acquisition in English is reciprocal (Perfetti, Beck, Bell, & Hughes, 1987).

1.4 Development of phonological awareness skills in Chinese

Although the development of phonological awareness in alphabetic languages has been investigated by a large number of studies (see Gombert, 1992; Gillon, 2004, for a review), the developmental pattern of phonological awareness in non-alphabetic languages such as Chinese has rarely been examined. Ho and Bryant (1997b) studied the development of rhyme and tone awareness of Chinese children from age 3 to 8 in Hong Kong. For kindergarten children, the "similarity format" (i.e., ask the child to decide which of two stimuli sound similar to the target) with corresponding pictures was used in the testing. The kindergarten children were required to make judgments based on rhyme and tone together, rhyme alone, or tone alone. For the primary school children, the "oddity format" (i.e., ask the child to pick the odd sound out of three choices) without corresponding pictures was used. The awareness of onset and rhyme was examined for the primary school children. The results from this study suggested that Chinese children first develop the awareness of relatively large sound segments (e.g., rhyme/tone together) and gradually acquire the ability to detect either rhyme or tone alone. However, the researchers did not test awareness of other aspects of the phonological system, such as syllables. Thus, the results from that study cannot comprehensively represent the development of different
phonological awareness skills in Chinese.

Moreover, the different approaches used by teachers in Hong Kong and in Mainland China may affect the developmental profile of phonological awareness in children. Teachers in Hong Kong use a whole-word approach ("look and say") to teach children to read, while Pinyin, an alphabetic writing system, is taught to children in Mainland China around the age of six years to help them pronounce Chinese characters. Read, Zhang, Nie, & Ding (1986) and Adams (1990) indicated that experience in reading an alphabetic language promotes the development of phonological awareness, especially phonemic awareness. Similarly, knowledge of Pinyin has been shown to facilitate syllabic, onset-rime, and phonemic awareness in Chinese (Siok & Fletcher, 2001; McBride-Chang, Bialystok, Chong, & Li, 2004; Cheung, Chen, Lai, Wong, & Hills, 2001; Ping, Fen, & Ruiping, 2006). Because of these differences in the two teaching systems, children in Mainland China may have a different developmental profile of phonological awareness than children in Hong Kong. Thus, it is important to establish the developmental profile of phonological awareness of Chinese monolingual children in Mainland China.

In order to understand the development of phonological awareness in Chinese children, the relevant levels of phonological awareness for learning to read Chinese are discussed in the following sections. Research on phonological awareness and Chinese reading acquisition in the past decade has suggested that three levels of phonological awareness are critical for learning to read Chinese: syllable awareness (McBride-Chang & Ho, 2000; McBride-Chang & Kail, 2002), onset-rime awareness (Ho & Bryant, 1997a; Hu & Catts, 1998; So & Siegel, 1997; Siok & Fletcher, 2001), and tone awareness (Ho & Bryant, 1997a; So & Siegel, 1997). Phonemic
awareness, which is central to English reading acquisition (Bruck, Genesse, & Caravolas, 1997), has been suggested not to be important in learning to read Chinese in a couple of previous studies (Huang & Hanley, 1995; Siok & Fletcher, 2001).

1.4.1 Tone awareness

As a tonal language, Chinese uses four tones (in Mandarin: high-level, mid-rising, mid-falling-rising, and high-falling, which are represented by numbers one to four, respectively) as a supra-segmental feature to change the meanings of syllables (Tseng, Massaro, Cohen, 1986). Chinese children have to use tone awareness to differentiate between words which differ only in tone, such as 八 /ba1/, meaning ‘eight’, as compared with 爸 /ba4/, meaning ‘dad’ (Anderson, Li, Ku, Shu, & Wu, 2003). Tone is the most salient concept for Chinese speakers (Zhu, 2002). It is acquired through exposure to spoken Chinese and is a component of leaning to read Chinese (Ho & Bryant, 1997a; So & Siegel, 1997; Anderson, Li, Ku, Shu, & Wu, 2003).

1.4.2 Syllable awareness

Compared with English, Chinese is a syllabic and non-inflected language. Syllables are the basic units of spoken Chinese and are represented by Chinese characters in the writing system. In other words, Chinese orthography maps directly onto speech at the level of syllables. Therefore, learning to read Chinese requires that children are able to understand character-to-syllable correspondence (Li, Anderson, Nagy, & Zhang, 2002). In addition, most Chinese words consist of two or three characters. Many component syllables (represented by characters) in Chinese words can be present in isolation and have different meanings from the multi-character (or mutli-syllabic) words. For example, 心 /kai1xin1/ means “happy” while 开 /kai1/ and 心
/xin1/ have the meaning of “open” and “heart”, respectively. Therefore, learning Chinese requires syllable awareness, which is the understanding of the concept of the syllable and the ability to break down words into syllables. Syllable deletion tasks have been used in previous studies to measure syllable awareness in Chinese. The results from those studies have indicated that children’s performance on syllable deletion tasks predicts their Chinese character recognition ability (McBride-Chang & Ho, 2000; McBride-Chang & Kail, 2002).

1.4.3 Onset-rime awareness

Traditionally, a Chinese syllable can be divided into two parts: an initial consonant and a final part, which has a vowel component with or without a consonant. According to the definition of “rhyme” given by Xinhua Dictionary (10th edition, 2004), Chinese words rhyme when they have the same final part and tone, e.g., 午 /wu3/ and 了 /tu3/.

About 40% of the semantic-phonetic compound characters that children learn in elementary schools are semi-regular characters; that is, a character may be pronounced with either a different tone (e.g., 供 /gong1/ has the first tone whereas its phonetic radical 共 /gong4/ has the fourth tone) or a different onset from its phonetic radical (e.g., 呈 /pa1/ and its phonetic radical 八 /ba1/ have different onsets) (Shu, Chen, Anderson, Wu, & Xuan, 2003). Previous studies have suggested that when discerning the pronunciations of unfamiliar semi-regular characters, children rely heavily on utilizing the rhyming clues provided by phonetic radicals, and this ability to make analogies between the phonetic component and the whole word is related to children’s performance on onset-rime awareness tasks (Anderson, Li, Ku, Shu, & Wu, 2003; He, Wang, & Anderson, 2005). In other words, children who have better onset-rime awareness
skills demonstrate better ability to decode unfamiliar semi-regular characters. Therefore, onset-rime awareness is crucial to learning to read Chinese (Ho & Bryant, 1997a; Hu & Catts, 1998; So & Siegel, 1997; Siok & Fletcher, 2001).

In Mainland China, teachers and/or parents use Pinyin, an alphabetic writing system, to explain onsets and rimes explicitly to younger children and train them to combine onsets and rimes to acquire pronunciations of characters (Ingulsrud & Allen, 1999). Rimes consisting of a vowel and a final consonant such as /an/ are not further divided into individual phonemes and appear to be memorized as whole components by Chinese children (Ingulsrud & Allen, 1999). Because the purpose of applying the Pinyin system is to help children acquire/learn the pronunciations of characters, learning to combine onsets and rimes is particularly emphasized in this teaching. Therefore, with the help of this system, it could be expected that children in Mainland China would acquire onset-rime awareness at a young age.

In sum, the development of the three levels of phonological awareness (i.e., tone awareness, syllable awareness, and onset-rime awareness) related to Chinese reading acquisition is the focus of the present study. Similar to the different levels of phonological awareness in alphabetic languages, the relationship between tone, syllable, and onset-rime in Chinese is hierarchical. Tone is a super-syllabic feature; thus, it is at the top of the hierarchy. Chinese syllables can also be divided into onsets and rimes; hence, syllables are in the middle of the hierarchy, while onsets and rimes are at the lowest level. Therefore, if Chinese-speaking children follow the developmental pattern of phonological awareness in alphabetic languages, that is, develop awareness of larger phonological segments first, it is expected that the
development of phonological awareness in Chinese would start with tone awareness, followed by syllable awareness, and end with onset-rime awareness.

1.5 Phonological awareness and bilingualism

Given our knowledge of the development of phonological awareness in monolingual children, recent studies have focused on examining phonological awareness in bilingual children because research has shown that bilingual children develop more advanced metalinguistic awareness than monolingual children (Cummins, 1978; Bialystok, 1986; Yelland, Pollard, & Mercuri, 1993). Because differences between their two languages allow bilingual children to become aware of language as an objective system, bilingual children have shown advantages in word awareness and syntactic awareness (see Bialystok, 2001, for a review). It has also been established in the previous studies that bilingual children tend to perform better than monolinguals on phonological awareness tasks (Bruck & Genesee, 1995; Yelland, Pollard, & Mercuri, 1993; Chen, Anderson, Li, Hao, Wu, & Shu, 2004).

One of the methodological factors that must be considered when studying development in bilingual children is how we define bilingual. Bilingualism is a continuum, which includes children who are fully proficient in both languages to those who are only partially so. Therefore, it is difficult to find a homogenous group of children with the exact same level of bilingualism. Moreover, research has shown that balanced bilinguals are rare and they tend to have a stronger and a weaker language (Bialystok, 2001). Therefore, in order to describe bilingual children's relative levels of proficiency in both languages, most researchers have measured bilingual children's performance on the Peabody Picture Vocabulary Test (PPVT) when interpreting
potential effects of bilingualism (Bruck & Genesee, 1995; Yelland, Pollard, Mercuri, 1993; Bialystok, McBride-Chang, & Luk, 2005; Bialystok, Majumder, & Martin, 2003; Hu, 2003). As a measure of language proficiency, PPVT has been widely used in these previous studies when examining the effect of bilingualism on phonological awareness.

The relationship between bilingualism and phonological awareness has been studied by examining whether phonological awareness in one language can predict reading acquisition in another language, and whether bilingual children perform differently than monolingual children on phonological awareness tasks.

1.6 Cross-language transfer of phonological awareness

Phonological awareness skills in one language could be an important predictor of reading acquisition in another language (Durgunoglu, Nagy, & Hancin-Bhatt, 1993; Comeau, Cormier, Grandmaison, & Lacroix, 1999; Gottardo, Siegel, Yan, & Wade-Woolley, 2001; Chow, McBride-Chang, & Burgess, 2005). This cross-linguistic transfer effect was first observed between alphabetic languages. For example, Durgunoglu, Nagy, and Hancin-Bhatt (1993) studied Spanish-speaking first graders in transitional bilingual programs. The results from multiple-regression analyses revealed that children’s phonemic awareness in Spanish (L1) predicted their Spanish (L1) and English (L2) word recognition. Comeau, Cormier, Grandmaison, and Lacroix (1999) conducted a longitudinal study with English-speaking children in French immersion classes. The findings from regression analysis suggested that children’s syllabic and phonemic segmentation skills in English (L1) strongly predicted their English (L1) and French (L2) word decoding abilities. Both studies indicated that the acquisition of phonological awareness in one
alphabetic language aids in developing literacy skills in both alphabetic languages for bilingual children. This is not surprising given the fact that there are many phonological and orthographic similarities between different alphabetic languages; for instance, they tend to map written letters onto spoken phonemes.

Few studies have investigated whether the cross-linguistic transfer effects of phonological awareness occur between alphabetic and non-alphabetic languages such as English and Chinese. Gottardo, Siegel, Yan, and Wade-Woolley (2001) tested 65 school-age Cantonese-speaking children who were learning English as a second language to examine the relationship between phonological, syntactic, and orthographic processing skills in both languages and English reading abilities. Rhyme detection and tone detection were used to measure phonological awareness in Chinese. Their findings showed that the Chinese rhyme detection task was significantly correlated with English rhyme detection and phoneme deletion tasks, and it predicted the children’s English word reading skills as measured by the word-reading subtest of the Wide Range Achievement Test 3 (WRAT-3; Wilkinson, 1995). Similarly, Chow, McBride-Chang, and Burgess (2005) conducted a nine-month longitudinal study with Cantonese-speaking kindergarteners who were learning English as a second language to examine the associations between phonological awareness in Chinese (measured by a syllable deletion task) and both Chinese and English word reading skills. The results from regression analysis indicated that Chinese syllable deletion ability significantly predicted Chinese and English word reading. Therefore, both studies indicated that the cross-linguistic transfer effects of phonological awareness are not restricted to alphabetic languages. Children’s phonological awareness in non-
alphabetic languages such as Chinese can also predict their reading acquisition in alphabetic languages such as English.

In sum, cross-linguistic research so far has suggested that phonological awareness in one’s native language (L1) is an important predictor of learning to read in the L1 and the L2 (second language); therefore, assessing phonological awareness in bilingual children’s L1 would assist speech-language pathologists (SLPs) and literacy specialists in predicting their reading acquisition in both languages. Also, building children’s phonological awareness in their L1 might help improve their reading ability in both the L1 and the L2. This is particularly important for bilingual children who cannot be assessed in English due to limited English proficiency. In this case, the information that clinicians and educators gather in bilingual children’s L1 could help them differentiate language differences from true disorders (Gorman & Gillam, 2003).

1.7 Bilingual advantage in phonological awareness

Cummins (1978) reviewed discrepant findings in the various studies which investigated the effect of bilingualism on cognitive and linguistic development. He noted that the two languages in a bilingual speaker are interdependent and further proposed the threshold hypothesis; that is, the effect of bilingualism on cognitive and linguistic development depends on the child’s level of proficiency in the two languages. Partially bilingual children demonstrate moderate advantages and children with high proficiency in both languages (i.e., balanced bilinguals) show most positive outcome (Cummins, 1978).

Previous research has shown that, when compared with monolingual children, bilingual children have more advanced phonological awareness (Bruck & Genesee, 1995; Yelland, Pollard,
Some studies have reported early advantages for bilingualism. For example, Bruck and Genesee (1995) compared English-speaking students in a monolingual school with those in a French immersion program longitudinally from kindergarten to Grade 1. Onset-rime segmentation, syllable counting, and phoneme counting tasks were studied in English, the children's stronger language. The results showed that there was an advantage for the bilingual children in onset-rime segmentation in kindergarten, but it disappeared in Grade 1. Bruck and Genesee (1995) attributed this initial bilingual advantage to bilingualism itself because the kindergarten children had not received any reading instruction. In first grade, they found that the bilingual children performed better on the syllable counting task, whereas English monolingual children performed better on the phoneme counting task. This mixed finding was explained by the different instructions that these children were received (Bruck & Genesee, 1995). Similarly, Yelland, Pollard, and Mercuri (1993) compared English monolingual children with children who were native speakers of English and learning Italian as a second language in kindergarten and Grade 1. The participants in this study were marginal bilinguals because the bilingual children were only received an hour of Italian instruction each week. Syllable awareness in English, the children's stronger language, was assessed. Children were asked to judge whether an object had a long or short name according to the sound structure of words (polysyllabic or monosyllabic). The results showed that bilingual children performed better than English monolingual children on this syllable awareness task, but, like Bruck & Genesee (1995), this bilingual advantage disappeared by the end of Grade 1. Together, both Bruck & Genesee's (1995) and Yelland, Pollard, & Mercuri's (1993) studies
suggested an early bilingual advantage in phonological awareness in bilingual children's stronger language. Their findings didn't support Cummins (1978)'s threshold hypothesis because the bilingual advantages in phonological awareness was observed in the early stages of second language (L2) acquisition when the bilingual children's language proficiency in L2 was very low. In contrast, Chen, Anderson, Li, Hao, Wu, and Shu (2004) studied the effect of bilingualism with balanced bilinguals. They compared school-aged (Grade 1 to Grade 4) Cantonese-Mandarin bilingual children in Guangzhou with Mandarin monolingual children in Beijing. The bilingual children were native Cantonese speakers receiving immersion Mandarin instruction at schools, and they were highly proficient in both languages. The children's awareness of tone, onsets, and rimes in Mandarin was assessed. The results indicated that the bilingual children developed more advanced onset and rime awareness than the monolingual children, but this bilingual advantage disappeared by Grade 4.

In sum, all of these aforementioned studies (Brack & Genesee, 1995; Yelland, Pollard, & Mercuri, 1993; Chen, Anderson, Li, Hao, Wu, & Shu, 2004) have suggested that bilingual children who maintain their native language as they acquire an additional language (i.e., additive bilinguals) have initial advantages in phonological awareness compared with monolingual children, with more balanced bilinguals maintaining this advantage longer. According to the background information that we gathered from our pilot study, most Chinese-English bilingual children are additive bilinguals who continue to use Chinese with their family members while they are learning English at school. Therefore, initial bilingual advantages were expected in phonological awareness tasks given to Chinese-English bilingual children in Canada. Moreover,
most previous studies (Bruck & Genesee, 1995; Yelland, Pollard, & Mercuri, 1993; Chen, Anderson, Li, Hao, Wu, & Shu, 2004) have only examined the effects of bilingualism on phonological awareness in one language, most often the bilingual children’s stronger language. The influence of bilingual exposure on phonological awareness in both languages has not yet been fully studied.

There is still some debate over whether the bilingual advantages observed in previous studies are due to children’s bilingual experience or to the phonological structures of their two languages. Chen et al. (2004) attributed the bilingual advantage found in their study to children’s bilingual experience because Cantonese and Mandarin share a similar phonological structure and the two groups of children received similar instruction at school. However, Bialystok, Majumder, & Martin (2003) argued that some of the bilingual advantages observed in previous studies might be due to the specificity of the languages learned rather than bilingualism. For instance, the advanced development of syllable awareness in English-French bilingual children observed in Bruck & Genesee (1995) might be due to learning French. Syllable units are emphasized in French because of the regularity of its syllable structures (Cutler, Mehler, Norris, & Segui, 1986); thus, children learning French might acquire advanced syllable awareness. Therefore, English-French bilingual children’s superior syllable awareness is likely due to learning the French language rather than their bilingual exposure (Bruck & Genesee, 1995; Bialystok, Majumder, & Martin, 2003). Therefore, in order to address the question whether there is a true bilingual advantage in developing phonological awareness, Bialystok et al. (2003) conducted a cross-sectional study with school-aged English monolingual children and two groups of bilingual
children: Spanish-English bilinguals and Chinese-English bilinguals. Chinese or Spanish was still the language of the family and cultural community for the bilingual children while they were learning English as a second language at schools. In that study, phonological awareness in English was assessed by the phoneme segmentation and phoneme substitution tasks. The findings showed that Chinese-English bilinguals performed worse than English monolinguals on a phoneme segmentation task, but Spanish-English bilinguals performed better. Thus, Bialystok et al. (2003) suggested that bilingualism itself may not be an advantage for the development of phonological awareness, because they then would have observed superior performance on the phoneme segmentation task in both bilingual groups; however, the knowledge of another alphabetic language with transparent letter-sound correspondence (e.g., Spanish) may have facilitated the acquisition of phonological awareness in English because the two languages share similar phonological and orthographic structures.

1.8 The present study

The preceding review of the development of phonological awareness in alphabetic languages and Cantonese suggests that the development of phonological awareness progresses from an awareness of larger phonological segments (e.g., syllables) gradually to smaller ones (e.g., onset-rimes) (Treiman & Zukowski, 1991; Ho & Bryant, 1997b). However, the developmental pattern of phonological awareness in Mandarin has never been studied. Without knowing the development of phonological awareness in Mandarin monolingual children, it is not possible to identify any effects of English exposure on phonological awareness in Mandarin for Mandarin-English bilingual children. Therefore, the first study of this thesis attempts to examine
how Mandarin-speaking children in Mainland China develop various phonological awareness skills (syllable, onset-rime, and tone awareness) across ages (from age 4 to 6).

Cross-linguistic research so far has established that phonological awareness in one language is an important predictor in reading acquisition in another language, and this cross-linguistic transfer of phonological awareness exists not only between alphabetic languages but also between alphabetic and non-alphabetic languages such as English and Chinese (Durgunoglu, Nagy, & Hancin-Bhatt, 1993; Comeau, Cormier, Grandmaison, & Lacroix, 1999; Gottardo, Siegel, Yan, & Wade-Woolley, 2001; Chow, McBride-Chang, & Burgess, 2005). Although bilingual children have generally been found to perform better than monolingual children on phonological awareness tasks, there is still some debate among researchers whether bilingual children’s superior phonological awareness skills are due to the characteristics of the two languages or to bilingual exposure (Bruck & Genesee, 1995; Bialystok, Majumder, & Martin, 2003; Chen, Anderson, Li, Hao, Wu, and Shu, 2004). Moreover, bilingual children whose two languages are distantly related in terms of phonology and orthography, such as Mandarin and English, have been considered unlikely to show advantages in phonological awareness (Bialystok, Majumder, & Martin, 2003). Therefore, the second study of this thesis attempts to examine the effects of bilingual exposure on the development of phonological awareness in Mandarin and in English for Mandarin-English bilingual children. If the bilingual advantage in phonological awareness is due to the properties of the two languages rather than bilingualism itself, as suggested by Bialystok et al. (2003), it is expected that Mandarin-English bilingual children would not outperform Mandarin monolinguals on the Chinese-specific phonological
awareness tasks, such as tone discrimination. Also, the Mandarin-English bilingual children would not be expected to outperform English monolinguals on English phonemic awareness tests because acquisition of written Chinese does not rely on phonemic awareness (Cheung, Chen, Lai, Wong, & Hills, 2001; McBride-Chang, Bialystok, Chong, & Li, 2004). On the other hand, if bilingualism plays a facilitative role in the development of phonological awareness, Mandarin-English bilingual children would be expected to outperform their Mandarin monolingual counterparts on Chinese-specific phonological awareness tasks, and would also demonstrate advantages on English phonemic awareness tests when compared with English monolinguals.

To summarize, the two studies of this thesis aim to provide answers to the following research questions:

(1) How do Mandarin-speaking preschoolers develop various phonological awareness skills between the ages 4 to 6? Does the development of phonological awareness in Mandarin follow the general developmental pattern observed in alphabetic languages; that is, do children develop awareness of relatively larger segments (e.g., syllables) earlier than awareness of smaller ones (e.g., onset-rime)?

(2) Are there bilingual advantages in phonological awareness for Mandarin-English bilingual children? If so, does this bilingual advantage exist only in the stronger or weaker language of Mandarin-English bilingual children or in both languages?
2 STUDY 1: DEVELOPMENT OF PHONOLOGICAL AWARENESS IN CHINESE

2.1 Method

2.1.1 Participants

91 Mandarin-speaking children were selected from two mid-ranking kindergartens (according to the fee that parents need to pay for their child every month) in Shanghai, China. The two kindergartens were located in middle-class neighborhoods. All the participants attended kindergarten five days a week. Children in Shanghai go to kindergarten after the age of 4. Although formal reading instruction typically begins around the age of 6 (with the teaching of Pinyin), teachers provide formal instruction in other subjects such as art and music. The general expectation in the culture is that kindergartens and schools are the main places for children to acquire literacy skills, and little or no literacy activities are taught at home; thus, the classroom teachers, rather than the parents, were interviewed regarding the children’s literacy activities, such as learning Pinyin. Based on the teachers’ reports, all participants were exposed to the local dialect (i.e., Shanghainese) at home. However, only Mandarin was used in the kindergartens, and more than 90% of the children also communicated with their parents in Mandarin. Therefore, Mandarin was considered the dominant language of all the participants. Although Shanghainese and Mandarin are not mutually intelligible, they share similar phonological structures. For instance, Shanghainese and Mandarin are both tonal languages and have the same syllable structure. Thus, limited exposure to Shanghainese is not likely to affect the children’s development of phonological awareness in Mandarin.

In Mainland China children typically enter school at the age of 7 years. Pinyin is
formally taught during the first five to twelve weeks of Grade 1 (Ingulsrud, & Allen, 1999).

However, the teachers of these two kindergartens introduce the Pinyin system to children when they are 6 years old. Children in these two kindergartens were minimally exposed to English; they were only taught single words and had no functional skills or literacy experience in English.

According to the teachers' reports, all the participants had normal or corrected-to-normal vision, normal hearing and no history of any physical, emotional, or cognitive difficulties.

Traditionally, kindergarten children are divided into three classes according to their age: Age 4 (4;0-4;11), Age 5 (5;0-5;11), and Age 6 (6;0-6;11). The participants in this study were thus divided into these three age groups. The characteristics of the participants are listed in Table 1.

<table>
<thead>
<tr>
<th>Age</th>
<th>Age range</th>
<th>Mean age</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 yr.</td>
<td>4;1-4;11</td>
<td>4;8</td>
<td>16</td>
<td>14</td>
<td>30</td>
</tr>
<tr>
<td>5 yr.</td>
<td>5;0-5;11</td>
<td>5;4</td>
<td>14</td>
<td>17</td>
<td>31</td>
</tr>
<tr>
<td>6 yr.</td>
<td>6;0-6;11</td>
<td>6;5</td>
<td>19</td>
<td>11</td>
<td>30</td>
</tr>
</tbody>
</table>

2.1.2 Procedures and Tasks

The participants completed testing in a single session. All tasks were presented in a fixed order by a native speaker of Mandarin.

2.1.2.1 Language proficiency in Chinese

_The Chinese version of the Peabody Picture Vocabulary Test (PPVT) (Dunn & Dunn, 1981)._ The Chinese PPVT is a standardized test of receptive vocabulary. The child was asked to pick out one picture out of four choices which corresponds to the aurally presented word. In this
study, the standard scores of PPVT were used in the analysis.

2.1.2.2 Phonological awareness tasks in Mandarin

Five phonological awareness tasks in Mandarin were developed for the present study. The Syllable Deletion, Onset-rime Combination, and Initial Sound Identification tasks were developed to match the three subtests of the Comprehensive Test of Phonological Processing (CTOPP, Wager, Torgesen, & Rashotte, 1999), namely Elision, Blending, and Sound Matching. The Rhyme Detection and Tone Discrimination tasks were adapted from So & Siegel (1997). The Syllable Deletion and Tone Discrimination tasks were used to assess awareness of syllable and tone, respectively, whereas the Onset-rime Combination, Initial Sound Identification, and Rhyme Detection tasks were all used to examine onset-rime awareness in Chinese.

2.1.2.2.1 Tone Discrimination

This task was also adapted from So & Siegel (1997). It consisted of 12 experimental trials including all the possible contrasts among the four tones in Mandarin (Appendix A). The number of characters was decreased from four to three in each trial in order to avoid memory overload, because we tested preschoolers while So & Siegel (1997) tested school-aged children. For this task, all the words in each trial shared the same syllable. Two of the words had the same tone while one word had a different tone. Therefore, children were required to use tone to distinguish between the words. For the three stimuli in each trial, the same syllable was used because based on a pilot study it was found that it was difficult for a preschooler to make judgement of oddity along one dimension when another dimension was also manipulated. For this tone discrimination task, in each trial, children heard three words and were asked to pick out
the word which has a different tone, e.g., ‘/kun4/, /kun1/ and /kun1/’, which word sounds
different, the first, the second or the third?’. In order to avoid any possibilities that errors were
related to tone production rather than tone perception, a numerical response was requested rather
than producing the word. The raw score was the total number correct from the list of 12 items.

2.1.2.2.2 Syllable Deletion

This task consisted of 15 compound words (Appendix B). Children were asked to
reproduce the word without one of the syllables. In each trial, the examiner first asked the child
to repeat the stimulus and then requested the child to delete a specific syllable from the word
(e.g., ‘Say /dian4//hua4/ without /dian4/’). The resulting words were real words in Mandarin.
The raw score was the total number correct from the list of 15 items.

2.1.2.2.3 Onset-rime Combination

The purpose of this task was to determine children’s ability to combine onsets and rimes
into words (Appendix C). Learning to read Chinese does not require children to combine sounds
into words because Chinese characters map onto the speech at the level of syllables (Tzeng,
2002). However, children in Mainland China may develop this ability as a result of Pinyin
instruction. In this task, children heard two or three parts of a syllable and were asked to say the
complete word (e.g., ‘Put these sounds together: b-ei. What word do they make?’). The
component sounds were audio-recorded by a native Mandarin speaker. The raw score was the
total number correct from the list of 12 items.

2.1.2.2.4 Initial Sound Identification

The Initial Sound Identification task in this study consisted of 10 experimental items
(Appendix D). We only tested children’s initial sound identification skill since there are no final consonants in most Chinese syllables and the only acceptable syllable-final consonants are alveolar and velar nasals (i.e., /n/ and /ŋ/) (Zhu, 2002). Children were shown pictures and asked which of three words starts with the same sound as the target words, e.g., ‘Which word starts with the same sound as ‘/fei1/’? /feng1/, /san1/ or /bei1/’’. The raw score was the total number correct from the list of 10 items.

2.1.2.2.5 Rhyme Detection

This task was adapted from So & Siegel (1997). It consisted of 15 experimental trials (Appendix E). Again, the number of characters was decreased to three in each trial to avoid memory overload for preschoolers. All the stimuli were real words in Mandarin and were audio-recorded by a native Mandarin speaker. In each trial, all the three words had a different onset. Therefore, children were not able to contrast them based on the phonological information of the onsets. Two of the words shared the same tone and rime (i.e., they rhyme based on the definition of rhyme in Chinese) while one word had the same tone but a different rime. Thus, children could only rely on the rime difference to detect the odd one. For this task, children listened to three words in each trial and were asked to identify which word did not rhyme, e.g., ‘/shi4/, /xi4/ and /guo4/’. All the words were real words in Mandarin. The raw score was the total number correct from the list of 15 items.

2.2 Results

The raw scores of Mandarin phonological awareness tasks were converted into correct percentages to facilitate the comparison across ages because these tasks have different lengths.
The descriptive statistics for the Chinese PPVT and Mandarin phonological awareness measures are summarized in Table 2 and are plotted in Figure 1.

Table 2: Chinese PPVT and mean correct percentages of phonological awareness tasks in Mandarin-speaking children

<table>
<thead>
<tr>
<th></th>
<th>4 yrs M</th>
<th>4 yrs SD</th>
<th>5 yrs M</th>
<th>5 yrs SD</th>
<th>6 yrs M</th>
<th>6 yrs SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tone Discrimination</td>
<td>0.70</td>
<td>0.22</td>
<td>0.81</td>
<td>0.18</td>
<td>0.78</td>
<td>0.19</td>
</tr>
<tr>
<td>Syllable deletion</td>
<td>0.44</td>
<td>0.25</td>
<td>0.60</td>
<td>0.21</td>
<td>0.74</td>
<td>0.22</td>
</tr>
<tr>
<td>Onset-rime combination</td>
<td>0.11</td>
<td>0.23</td>
<td>0.06</td>
<td>0.13</td>
<td>0.54</td>
<td>0.39</td>
</tr>
<tr>
<td>Initial sound identification</td>
<td>0.34</td>
<td>0.15</td>
<td>0.47</td>
<td>0.18</td>
<td>0.45</td>
<td>0.20</td>
</tr>
<tr>
<td>Rhyme Detection</td>
<td>0.42</td>
<td>0.21</td>
<td>0.42</td>
<td>0.16</td>
<td>0.46</td>
<td>0.18</td>
</tr>
</tbody>
</table>

The standard scores of Chinese PPVT were analyzed with a one-way analyses of variance (ANOVA). The results showed that the three age groups were equivalent on the Chinese PPVT, indicating that all children performed age-appropriately on this single-word comprehension measure. A one-way repeated-measures ANOVA was used to determine whether there were main effects of age and phonological awareness tasks. 'Age' was the between-subject factor while level of phonological awareness was the within-subject factor. The results indicated that there was an effect of phonological awareness ($F (4, 85) = 104.81, p < .0001$) and an effect of age ($F (2) = 14.22, p < 0.001$). Also, there was an interaction between age and phonological awareness tasks ($F (8, 170) = 10.02, p < .0001$). Results from the post-hoc test (i.e., Tukey HSD) revealed that all three age groups performed equivalently on the Rhyme Detection and the Tone.
Discrimination tasks. However, all three age groups were different from each other on the Syllable Deletion task ($p<.05$). For the Onset-rime Combination task, the 4-year-olds performed equivalently to the 5-year-olds, but the 6-year-olds significantly outperformed the two younger groups on this task ($p<.05$). For the Initial Sound Identification task, the performance of the 5-year-olds and 6-year-olds were equivalent, but both groups performed significantly better than the 4-year-olds ($p<.05$).

Figure 1 further shows the development of different phonological awareness skills in Mandarin. The chance level for the Initial Sound Identification, Rhyme Detection, and Tone Discrimination tasks was 33% since children were requested to pick one answer out of three choices in these tasks. As indicated in Figure 1, Mandarin-speaking children develop the awareness of tone earlier than other phonological awareness skills. All the age groups performed significantly above the chance level for the Tone Discrimination task. The awareness of syllables develops after Mandarin-speaking children have acquired tone awareness. By the age of six, Mandarin-speaking children were able to give correct answers to 74% of the test items in the Syllable Deletion task. The awareness of onsets and rimes were measured by the Onset-rime Combination, the Initial Sound Identification, and the Rhyme Detection tasks in this study. All the participants performed poorly on these tasks. By age 6, Mandarin-speaking children achieved a correct rate of 54% on the Onset-rime combination, 45% on the Initial Sound Identification, and 46% on the Rhyme Detection tasks.
2.3 Discussion

The present study demonstrated that Mandarin-speaking children develop different phonological awareness skills at different ages, beginning with tone awareness, followed by syllable awareness, and ending with onset-rime awareness. As predicted, this developmental pattern is consistent with the one found in English-speaking children (Treiman & Zukowski, 1991; Gombert, 1992) and Cantonese-speaking children (Ho & Bryant, 1997b), i.e., children develop an awareness of relatively large phonological segments (e.g., syllables) earlier than smaller ones (e.g., onsets and rimes). This may suggest an underlying cognitive developmental pattern universal to all languages.

Tone is the most salient feature for Chinese-speaking children and is crucial for disambiguating the meaning of Chinese syllables with the same phonemes (Anderson, Li, Ku,
Therefore, it is not surprising that Chinese-speaking children develop tone awareness ahead of other phonological awareness skills. Chinese children’s strong performance on the Tone Discrimination task before entering school indicates that they are able to develop the awareness of tone spontaneously by speaking this tonal language.

The syllable is another important phonological structure in Chinese since it is the basic unit of spoken Chinese and is represented by characters in the Chinese writing system (McBride-Chang & Ho, 2000; McBride-Chang & Kail, 2002). The simple syllable structures (CV and CVC) in Chinese make syllables very salient to Chinese speakers. In addition, tone is embedded in each syllable. Therefore, Chinese-speaking children were found to develop syllable awareness rapidly after the age of 4 when they have acquired tone awareness.

However, Chinese-speaking children’s performance on the tasks that were designed to measure the awareness of onsets and rimes, i.e., the Onset-rime Combination, Rhyme Detection, and Initial Sound Identification tasks, was poor. The correct response rates on these tasks were lower than 60% by the age of six. Adams (1990) noted that the conscious knowledge of phonemes does not develop spontaneously in English-speaking children, and further reading instruction facilitates children’s acquisition of skills in phonemic awareness in English. Similarly, speaking Chinese may not be sufficient for children to develop the awareness of onsets and rimes. Mandarin-speaking children may need Chinese reading instruction in order to fully develop onset-rime awareness.

A number of studies have indicated that literacy exposure affects the development of phonological awareness (Adams, 1990; Cheung, Chen, Lai, Wong, & Hills, 2001; McBride-
Chang & Kail, 2002; McBride-Chang, Bialystok, Chong, & Li, 2004). In the current study, a positive effect of Pinyin instruction on the development of onset-rime combination skill in Chinese was observed. According to the teachers’ reports, children were taught the pronunciations of onsets and rimes in the Pinyin system and how to combine them to form syllables at the age of 6. When teaching Pinyin in Mainland China, rimes such as /ing/ are memorized as a whole chunk and children are not told that these rimes can be further divided into phonemes (e.g., /i/ and /ng/) (Ingulsrud & Allen, 1999). Training to blend onsets and rimes to form syllables is particularly emphasized when teaching Pinyin because the purpose of learning Pinyin is to help children acquire the pronunciations of characters. Teachers even encourage children to recite all the possible combinations between onsets and rimes in Pinyin. Thus, the Pinyin instruction emphasizes the ability to be aware of and to manipulate the units of onsets and rimes. Children’s rapid development of the onset-rime combination skill at the age of 6 is likely due to the effect of Pinyin instruction. This result is also consistent with the conclusion in previous studies that learning Pinyin facilitates the development of phonological awareness in Chinese (Siok & Fletcher, 2001; McBride-Chang, Bialystok, Chong, & Li, 2004; Cheung, Chen, Lai, Wong, & Hills, 2001; Ping, Fen, & Ruiping, 2006).

However, Pinyin is not taught to children in Hong Kong. Therefore, it would be interesting to examine whether children in Mainland China develop onset-rime awareness earlier than children in Hong Kong. Ho and Bryant (1997b) examined the development of rhyme detection skills in Cantonese-speaking children between the ages of 7 and 8 in Hong Kong by using a similar Rhyme Detection task to the one utilized in the current study. Comparing the
results from Ho & Bryant (1997b) and those of the current study, it appears that the performance on the Rhyme Detection task of the 6-year-olds in the present study was equivalent to that of the 7-year-olds in Ho & Bryant's (1997b) study (46% vs. 46.7%). This finding suggests that children in Mainland China may acquire rhyme detection skills earlier than children in Hong Kong. Therefore, this developmental difference may be attributed to the exposure to the Pinyin system in Mainland China.
3 STUDY 2: EFFECTS OF BILINGUALISM ON PHONOLOGICAL AWARENESS

3.1 Method

3.1.1 Participants

The study included three groups of children. The first group consisted of the 61 Mandarin monolingual children in the Age 5 and Age 6 groups from Study 1.

The second group, the English monolinguals, consisted of 21 5-to-6-year-old children (9 males and 12 females) who were recruited from kindergartens in Vancouver, Canada. These children had no exposure to languages other than English according to parental questionnaire responses. They had normal or corrected-to-normal vision, normal hearing and no history of any physical, emotional, or cognitive difficulties.

The third group consisted of 62 5-to-6-year-old Chinese-English bilingual children who were recruited from the Chinese community in Greater Vancouver, Canada. Bilingual children and English monolingual children lived at the same districts and all came from middle-class families according to the background information provided by the parents. The characteristics of all the participants included in Study 2 are listed in Table 3. All the bilingual children had normal or corrected-to-normal vision, normal hearing and no history of any physical, emotional, or cognitive difficulties according to the parents’ reports. Information was gathered about the literacy activities and language exposure in the homes of the bilingual children with a background questionnaire filled out by their primary caregivers. For all the bilingual children, Chinese was used in the home between parents and the child whereas English was the language of school.
The bilingual children had a range of experience in terms of Chinese literacy. According to the results from the background questionnaire, one third of the bilingual children received literacy instruction in Chinese by attending Chinese schools or study groups or being taught by personal tutors. The aspects of Chinese instruction included speaking, reading, and writing, but mainly focused on reading. Parents reported that 28 out of 62 bilingual children acquired the knowledge of Pinyin.

Table 3: Participant characteristics in Study 2

<table>
<thead>
<tr>
<th></th>
<th>Mandarin monolingual group</th>
<th>Bilingual group</th>
<th>English monolingual group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5 yrs.</td>
<td>6 yrs.</td>
<td>5 yrs.</td>
</tr>
<tr>
<td><strong>Age range</strong></td>
<td>5;0-5;11</td>
<td>6;0-6;11</td>
<td>5;0-5;11</td>
</tr>
<tr>
<td><strong>Mean age</strong></td>
<td>5;4</td>
<td>6;5</td>
<td>5;6</td>
</tr>
<tr>
<td><strong>number</strong></td>
<td>31</td>
<td>30</td>
<td>36</td>
</tr>
</tbody>
</table>

3.1.2 Procedures and Tasks

The Mandarin monolingual children were tested using the Chinese PPVT and five phonological awareness tasks in Mandarin (i.e., Tone Discrimination, Syllable Deletion, Onset-rime Combination, Initial Sound Identification, and Rhyme Detection) as described in Study 1. The bilingual children were assessed both in Mandarin and English. They completed testing in two sessions, once in each language. The order of the languages was counterbalanced. Within each language session, all tasks were presented in a fixed order. The Chinese tasks were administered by a native speaker of Mandarin. Two English native speakers administered the English tests. The bilingual children were tested with the same battery of Chinese tasks as the
monolingual Chinese children. In addition, a series of standardized English tests were administered to the bilingual children and the English monolingual group:

3.1.2.1 Language proficiency in English

*Peabody Picture Vocabulary Test-III (PPVT-III, Dunn & Dunn, 1997).* The PPVT-III is a standardized test of single-word comprehension in English. It was used in the present study as a measure of the children's oral proficiency in English. In this study, the standard scores of PPVT were used in the analysis.

3.1.2.2 Phonological awareness tests in English

Three subtests of the Comprehensive Test of Phonological Processing (CTOPP, Wager, Torgesen, & Rashotte, 1999), namely Elision, Blending, and Sound Matching, were used to measure the English monolingual and Mandarin-English bilingual children's phonological awareness skills in English. The mean standard score is 10 with a standard deviation of 3 for each subtest.

*Elision.* This subtest was used to assess children's ability to delete speech segments from words.

*Blending.* Children's ability to combine speech segments into words was assessed in this subtest.

*Sound Matching.* Children's ability to identify word-initial and word-final phonemes was assessed in this subtest.

3.2 Results

3.2.1 Language proficiency
The means and standard deviations of the Chinese PPVT and English PPVT scores of all the children are shown in Table 4. As indicated in Table 4, all the participants performed age-appropriately on the Chinese PPVT and on the English PPVT. Independent-sample T-Tests were used to compare the bilingual children’s performance on the Chinese PPVT and the English PPVT within each age group. The 5-year-old bilingual children performed significantly better on the Chinese PPVT than on the English PPVT (t (70) = 5.16, p<.001), suggesting that their stronger language was Chinese. Although the difference between scores on the Chinese PPVT and those on the English PPVT in the 6-year-old bilingual children was not significant (t (50) = 1.75, p>.05), their mean on the Chinese PPVT was higher than on the English PPVT.

To compare the bilingual children’s performance on the Chinese PPVT to that of the Mandarin monolingual children within each age group, Independent-sample T-Tests was used. In the 5-year-old group, the bilingual children and Mandarin monolingual children were equivalent on the Chinese PPVT (t(65) =1.32, p>.05). However, in the 6-year-old group, the Mandarin monolingual children performed significantly better than the bilingual children (t(54) = 2.39, p<.05).

Within each age group, the bilingual children’s performance on the English PPVT was compared with that of the English monolingual children using the Independent-sample T-Tests. Although both the bilingual children and the English monolingual children performed age-appropriately on the English PPVT, the 5-year-old (t(49) =5.47, p<.001) and 6-year-old English monolingual children (t(30) = 2.58, p<.05) performed significantly better than bilingual children of the same age.
Table 4: Means and standard deviations of Chinese PPVT and English PPVT in Study 2

<table>
<thead>
<tr>
<th></th>
<th>Mandarin monolingual group</th>
<th>Bilingual group</th>
<th>English monolingual group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5 yrs.</td>
<td>6 yrs.</td>
<td>5 yrs.</td>
</tr>
<tr>
<td>Chinese PPVT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>116.22</td>
<td>116.37</td>
<td>110.08</td>
</tr>
<tr>
<td>SD</td>
<td>22.13</td>
<td>16.69</td>
<td>15.77</td>
</tr>
<tr>
<td>English PPVT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td></td>
<td>90.94</td>
<td>95.04</td>
</tr>
<tr>
<td>SD</td>
<td></td>
<td>15.70</td>
<td>17.51</td>
</tr>
</tbody>
</table>

3.2.2 Effects of Bilingualism on phonological awareness

The effect of bilingualism on English phonological awareness was examined by comparing the performance of the Mandarin-English bilingual children with that of the English monolingual children. The descriptive statistics for these English tests are summarized in Table 5 and the standard scores of these tests were used in the analysis. Three-way repeated-measures ANOVA was used to determine whether there was an effect of age, language group, and English phonological awareness tests. Age and language group were the between-subject factors while the level of English phonological awareness was the within-subject factor. The results showed that there was no main effect of age and level of English phonological awareness. Only the interaction between level of English phonological awareness and language group was significant ($F(2, 78) = 5.37, p < .01$). Post-hoc comparison revealed that the Mandarin-English bilingual children performed significantly better than the English monolingual children on the Elision and
Blending subtests of the CTOPP ($p<.05$).

Table 5: Performance on English phonological awareness tests in bilingual children and English monolinguals

<table>
<thead>
<tr>
<th></th>
<th>5 yrs.</th>
<th>6 yrs.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Elision</td>
<td>9.73</td>
<td>1.91</td>
</tr>
<tr>
<td>Blending</td>
<td>10.67</td>
<td>2.02</td>
</tr>
<tr>
<td>Sound Matching</td>
<td>10.93</td>
<td>1.71</td>
</tr>
</tbody>
</table>

To examine the effect of bilingualism on Mandarin phonological awareness, the bilingual children's performance on Mandarin phonological awareness was compared with that of the Mandarin monolingual children. The raw scores of Mandarin phonological awareness tasks were converted into percentage correct which were used in the analysis. The descriptive statistics for these tasks are reported in Table 6. A three-way repeated-measures ANOVA was used to determine whether there was an effect of age, language group, and level of Mandarin phonological awareness. Age and language group were the between-subject factors while level of Mandarin phonological awareness was the within-subject factor. The results revealed a main effect of level of Mandarin phonological awareness ($F$ (4, 116) = 77.74, $p<.0001$) and of age ($F$ (1) = 25.66, $p<.0001$) and of language group ($F$ (1) = 55.01, $p<.0001$), but there was no interaction between age and language group ($F$ (1) = 0.08, $p>.05$). The interaction between level of Mandarin phonological awareness and age ($F$ (4, 116) = 13.75, $p<.0001$) as well as between level...
of Mandarin phonological awareness and language group ($F(4, 116) = 13.75, p < .0001$) were significant. Post-hoc comparison showed that including children of both ages, the bilingual group performed significantly better than the Mandarin monolingual group ($p < .05$) on all Mandarin phonological awareness tasks except for Syllable Deletion.

Table 6: Performance on Mandarin phonological awareness tasks in bilingual children and Mandarin monolinguals

<table>
<thead>
<tr>
<th>Mandarin monolinguals</th>
<th>5 yrs</th>
<th>6 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Monolingual</td>
<td>Bilingual</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Tone Discrimination</td>
<td>0.81</td>
<td>0.18</td>
</tr>
<tr>
<td>Syllable Deletion</td>
<td>0.60</td>
<td>0.21</td>
</tr>
<tr>
<td>Onset-rime Combination</td>
<td>0.06</td>
<td>0.13</td>
</tr>
<tr>
<td>Initial Sound Identification</td>
<td>0.47</td>
<td>0.18</td>
</tr>
<tr>
<td>Rhyme Detection</td>
<td>0.42</td>
<td>0.16</td>
</tr>
</tbody>
</table>

The mean correct percentage scores on the Mandarin phonological awareness tasks were plotted in Figure 2 to facilitate comparisons across different language groups within each age. As shown in Figure 2, by the age of six, the bilingual children achieved above 70% accuracy on all the Mandarin phonological awareness tasks, whereas the Mandarin monolingual children achieved this level of accuracy on only the Syllable Deletion and Tone Discrimination tasks.
3.2.3 Transfer of phonological awareness skills across languages

In order to address the question of whether phonological awareness can be transferred across languages that are structurally and etymologically very different, the relationship between phonological awareness skills in each language was examined using partial correlations where the effects of vocabulary size in English and Chinese were controlled for. The results are reported in Table 7. Tone awareness is a Chinese-specific phonological awareness skill. Therefore, it was not related to any English phonological awareness tasks. Mandarin Onset-rime Combination and Mandarin Initial Sound Identification were related to the Blending (r= .51, p< .05) and Sound Matching subtests of CTOPP (r= .42, p< .05), respectively. The correlations observed between these tasks indicate the transfer of the same skills across languages. The
Mandarin Syllable Deletion task tested syllable awareness whereas the Elision task in English mainly examined phonemic awareness, with a small number of the test items targeting syllable awareness. These two tasks were significantly correlated with each other ($r= .42$, $p< .01$). The Mandarin Rhyme Detection task tests children’s segmentation skills. The correlation between this task and English tests which examine segmentation skills such as Elision ($r= .44$, $p< .01$) and Sound Matching ($r= .46$, $p< .01$) suggests a similar process of transfer across languages.

<table>
<thead>
<tr>
<th></th>
<th>English Elision</th>
<th>English Blending</th>
<th>English Sound Matching</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandarin Tone Discrimination</td>
<td>.17</td>
<td>.30</td>
<td>.08</td>
</tr>
<tr>
<td>Mandarin Syllable Deletion</td>
<td>.42**</td>
<td>.31</td>
<td>.34*</td>
</tr>
<tr>
<td>Mandarin Onset-rime Comb.</td>
<td>.47**</td>
<td>.51**</td>
<td>.23</td>
</tr>
<tr>
<td>Mandarin Initial Sound Iden.</td>
<td>.28</td>
<td>.32*</td>
<td>.42**</td>
</tr>
<tr>
<td>Mandarin Rhyme Detection</td>
<td>.44**</td>
<td>.19</td>
<td>.46**</td>
</tr>
</tbody>
</table>

**. Correlation is significant at the 0.01 level. *. Correlation is significant at the 0.05 level.

3.2.4 Phonological awareness and language and literacy experience in bilingual children

The descriptive statistics for the background variables reflecting the bilingual children’s language exposure and literacy activities at home are listed in Table 8. Numbers from one to five were used to code for the variables of amount of English or Chinese the child hear and use at home, from ‘Only Mandarin’ to ‘Only English’. As indicated in Table 8, the means of language exposure and language use at home were 2.08 and 2.19, respectively, indicating that the bilingual children hear and speak mostly Mandarin at home. Numbers from zero to three were used to
code for the variable of Number of Books at home. As listed in Table 8, the numbers of Chinese and English books at home were equivalent ($t(122) = -1.22, p>.05$). The frequency of Mom Read and Child Read were coded using numbers from zero to five. As shown in Table 8, the frequencies of mother reading Chinese and English to the child were equivalent ($t(122) = -1.21, p>.05$). However, the children read in English significantly more frequently than in Chinese at home ($t(122) = -6.74, p<.001$).

Table 8: Descriptive statistics on background variables in bilingual children

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of residence (yrs.)</td>
<td>3.41</td>
<td>2.07</td>
</tr>
<tr>
<td>Language exposure at home</td>
<td>2.08</td>
<td>0.56</td>
</tr>
<tr>
<td>Language use at home</td>
<td>2.19</td>
<td>0.71</td>
</tr>
<tr>
<td>Number of Chinese books</td>
<td>2.13</td>
<td>0.74</td>
</tr>
<tr>
<td>Number of English books</td>
<td>2.29</td>
<td>0.73</td>
</tr>
<tr>
<td>Mom read Chinese</td>
<td>3.74</td>
<td>1.31</td>
</tr>
<tr>
<td>Mom read English</td>
<td>4.03</td>
<td>1.35</td>
</tr>
<tr>
<td>Child read Chinese</td>
<td>2.13</td>
<td>1.64</td>
</tr>
<tr>
<td>Child read English</td>
<td>4.11</td>
<td>1.63</td>
</tr>
</tbody>
</table>

Pearson correlations between some of these background variables and the different tasks were used to examine whether home language and/or literacy experience affects bilingual children’s development of phonological awareness and language proficiency in both languages. The results from the correlation analysis are summarized in Table 9. The length of residence in Canada was negatively associated with the Chinese PPVT ($r = -.49, p<.01$) but positively
associated with the English PPVT ($r = .46, p < .01$) and English Elision ($r = .49, p < .01$) and Sound Matching ($r = .35, p < .01$). The trend of losing Chinese proficiency is well-recognized by the bilingual children’s parents because 64.52% of the parents expressed worry about their child forgetting how to speak Chinese, and 79.03% of the parents also worry that their child will not know how to read and write in Chinese. The number of Chinese books at home was not associated with language proficiency and phonological awareness in either language; however, the number of English books at home was related to these abilities in both languages. Similarly, the frequencies of mother reading Chinese and English to the child were not associated with language proficiency and phonological awareness in either language. However, the frequency of self-reading especially in English was positively associated with both Chinese and English phonological awareness tasks.
Table 9: Correlations between background variables and language proficiency and phonological awareness measures in both languages of bilingual children

<table>
<thead>
<tr>
<th></th>
<th>LOR</th>
<th>#CB</th>
<th>#EB</th>
<th>MRC</th>
<th>MRE</th>
<th>CRC</th>
<th>CRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPVT_C</td>
<td>-.49**</td>
<td>.18</td>
<td>-.31*</td>
<td>.18</td>
<td>-.05</td>
<td>.29*</td>
<td>-.11</td>
</tr>
<tr>
<td>Syll._C</td>
<td>.00</td>
<td>.04</td>
<td>.16</td>
<td>-.27*</td>
<td>-.13</td>
<td>.22</td>
<td>.36**</td>
</tr>
<tr>
<td>Onset-rime_C</td>
<td>.20</td>
<td>.08</td>
<td>.37**</td>
<td>-.20</td>
<td>.00</td>
<td>.35**</td>
<td>.46**</td>
</tr>
<tr>
<td>Initial S_C</td>
<td>.14</td>
<td>.09</td>
<td>.30*</td>
<td>-.22</td>
<td>-.01</td>
<td>.46**</td>
<td>.39**</td>
</tr>
<tr>
<td>Rhyme_C</td>
<td>.20</td>
<td>.08</td>
<td>.32*</td>
<td>-.24</td>
<td>-.16</td>
<td>.07</td>
<td>.30*</td>
</tr>
<tr>
<td>Tone_C</td>
<td>.03</td>
<td>.11</td>
<td>.16</td>
<td>-.02</td>
<td>-.09</td>
<td>-.02</td>
<td>.11</td>
</tr>
<tr>
<td>PPVT_E</td>
<td>.46**</td>
<td>.02</td>
<td>.46**</td>
<td>-.15</td>
<td>.12</td>
<td>-.01</td>
<td>.35**</td>
</tr>
<tr>
<td>Elision_E</td>
<td>.49**</td>
<td>.07</td>
<td>.44**</td>
<td>-.12</td>
<td>-.04</td>
<td>.07</td>
<td>.37**</td>
</tr>
<tr>
<td>Blending_E</td>
<td>.20</td>
<td>.04</td>
<td>.38**</td>
<td>-.23</td>
<td>-.06</td>
<td>.26*</td>
<td>.41**</td>
</tr>
<tr>
<td>Sound M_E</td>
<td>.35**</td>
<td>.12</td>
<td>.40**</td>
<td>-.17</td>
<td>-.11</td>
<td>.19</td>
<td>.35**</td>
</tr>
</tbody>
</table>

**. Correlation is significant at the 0.01 level. *. Correlation is significant at the 0.05 level.

Note: LOR=length of residence; #CB=number of Chinese books; #EB=number of English books; MRC=mom read Chinese; MRE=mom read English; CRC=child read Chinese; CRE=child read English

3.3 Discussion

3.3.1 Effects of bilingualism on phonological awareness

The results from Study 2 provided a positive answer to the research question whether there is a bilingual advantage in phonological awareness for Mandarin-English bilingual children. The bilingual advantage was observed not only in the strong language (i.e., Mandarin) but also in
the weaker language (i.e., English) of the Mandarin-English bilingual children. The bilingual group outperformed their English counterparts on the two standardized English phonological awareness tests (i.e., the Elision and Blending subtests of CTOPP). This finding indicates that exposure to another language, even one as different from English as Mandarin, promotes children's awareness of phonological structures in English. Similarly, Mandarin-English bilingual children outperformed their Mandarin monolingual counterparts on the Tone Discrimination task and three Mandarin phonological awareness tasks which test the awareness of onsets and rimes (i.e., Onset-rime Combination, Initial Sound Identification, and Rhyme Detection). This suggests that English exposure similarly facilitated bilingual children's tone awareness and onset-rime awareness in Mandarin.

Bialystok et al. (2003) suggested that the bilingual advantages in phonological awareness found in previous research are due to the linguistic properties of the two languages, rather than the positive effect of bilingualism. They further questioned whether there is a bilingual advantage in Chinese-English bilingual children because Chinese and English are distantly related in phonology and orthography. In the current study, Mandarin-English bilingual children demonstrated superior phonological awareness in both languages when compared with English monolingual and Mandarin monolingual children. There are two possible reasons for these bilingual advantages. First, bilingual children acquire simultaneously different phonological awareness skills when learning two languages, because different languages require different phonological awareness skills (see Goswami, 1999, for a review). Cheung et al. (2001) found that English-speaking children have better onset-rime awareness than Chinese-speaking children.
do. Therefore, the bilingual advantage in Mandarin onset-rime awareness tasks may be due to the experience of learning English rather than bilingualism itself. However, the fact that the bilingual children performed significantly better than the Mandarin monolingual children on the Tone Discrimination task cannot be explained by the linguistic properties of English since English is not a tonal language. Moreover, the bilingual children’s better performance on the English phonemic awareness tests cannot be attributed to learning Mandarin since we learned from Study 1 that speaking Mandarin is not sufficient for children to develop awareness of sub-syllabic structures. Therefore, it is likely the bilingual exposure, per se, facilities the development of Chinese tone awareness and English phonemic awareness.

In sum, this study confirmed that bilingualism plays a facilitating role in the development of phonological awareness skills in both languages. Previous research has mainly focused on investigating the effects of bilingualism on phonological awareness in bilingual children’s native language, which is usually their stronger language (Bruck & Genesee, 1995; Yelland, Pollard, & Mercuri, 1993). The current study suggests that the bilingual advantages in phonological awareness exist in both languages of Mandarin-English bilingual children. Because phonological awareness is crucial for learning to read Chinese and English (Adams, 1990; Ho & Bryant, 1997a), Mandarin-English bilingual children are likely to be better prepared for literacy acquisition in both languages when compared to their monolingual peers. Previous studies have established a bidirectional relationship between the development of phonological awareness and reading acquisition (Goswami, & Bryant, 1990). Formal reading instruction is an important source for children to further develop phonological awareness. Even if bilingual children have
established advanced phonological awareness skills in both languages before entering school, they may lose this advantage in their native language if only English instruction is provided to them. Therefore, cross-sectional and/or longitudinal studies of school-aged bilingual children are necessary to test this hypothesis further.

3.3.2 Language proficiency in bilingual children

Bilingual children generally perform more poorly than monolinguals on vocabulary size measures because their vocabulary is divided between two language systems (Merriman & Kutlesic, 1993; Umbel, Pearson, Fernandez, & Oller, 1992). Consistent with previous research (see Oller & Eilers, 2002, for a review), the English PPVT scores of the bilingual children were lower than those of English monolingual children in this study, even though they have been in Canada for more than three years (mean length of Canadian residence= 3.41 years). Therefore, educators need to be cautious when making assumptions about the English language proficiency of bilingual children based on how long they have been in Canada. It is widely accepted that the longer the child stays in an English-speaking country, the better his/her English proficiency becomes (Cummins, 1984). A positive relationship between the length of Canadian residence and the English PPVT scores further confirmed this trend. The Chinese PPVT scores of the Mandarin-English bilingual children were equivalent to those of the Mandarin monolingual children and better than their English PPVT scores, which suggests that Mandarin is still these bilingual children’s stronger language. Because bilingual children are likely to spend most of the first six years at home and Mandarin is the main language of the family, Canadian-born bilingual children may come to school with stronger skills in their first language.
A trend of losing Chinese language proficiency after beginning formal English instruction was observed in this study. In the bilingual group, Chinese proficiency declined from age five to age six, while English proficiency improved during that period. This type of first language attrition has been widely reported in previous research (Wong-Fillmore, 1991; Lambert, 1990). The loss of L1 may further affect bilingual children’s ability to establish their cultural identity, which in turn can cause lower academic achievement (Cummins, 1986). Therefore, it is necessary to preserve L1 proficiency in bilingual children. The various French-English bilingual programs in Canada have indicated that promoting language proficiency in the L1 entails no loss in the development of English skills (Cummins, 1983). However, bilingual education in a Chinese-English context has rarely been examined. Further research on this topic is needed in order to address the needs of the constantly growing immigrant population from China, especially in the major cities of Canada such as Vancouver and Toronto.

3.3.3 Transfer of phonological awareness skills across languages

Previous studies have suggested that phonological awareness skills acquired in a language can predict reading acquisition in this language and in other languages (Durgunoglu, Nagy, & Hancin-Bhatt, 1993; Comeau, Cormier, Grandmaison, & Lacroix, 1999; Gottardo, Siegel, Yan, & Wade-Woolley, 2001; Chow, McBride-Chang, & Burgess, 2005). Moreover, associations between phonological awareness skills in one language and those in another language have been observed (Durgunoglu, Nagy, & Hancin-Bhatt, 1993; Gottardo, Siegel, Yan, & Wade-Woolley, 2001). This cross-language transfer of phonological awareness skills is confirmed in this study. Associations were found between the Mandarin phonological awareness
tasks and the English phonological awareness measures, especially between the tasks that examine similar phonological processing skills such as the Mandarin Onset-rime Combination and the English Blending measures. Therefore, when a bilingual child’s phonological awareness cannot be assessed in English due to limited English proficiency, the assessment of phonological awareness in Mandarin will provide SLPs and educators with important information about the child’s abilities in both languages.

3.3.4 Factors influencing the development of phonological awareness

Bialystok (2001) noted that bilingual children’s development of phonological awareness is related to their language exposure and literacy activities. For language exposure, the positive relationships between the length of Canadian residence and English phonological awareness suggest that bilingual children tend to develop better English phonological awareness abilities as they are exposed to an English-speaking environment longer. This finding is consistent with the general conclusion that second language acquisition is closely related to the amount of exposure to that language (Genesee, Paradis, & Crago, 2004). For the literacy activities at home, the findings indicated that there are an equivalent number of Chinese books and English books in the bilingual children’s homes. The frequencies of the mother reading books to the child in Chinese and in English were equivalent; however, the children read books alone in English significantly more frequently than in Chinese. Because the Chinese books were used less frequently than the English books by the child, the number of Chinese books was not associated with phonological awareness in either language, whereas the number of English books was associated with phonological awareness in both languages. The frequencies of the mother reading to the child
were not associated with phonological awareness in either language, whereas the frequencies of the child’s self-reading were associated with phonological awareness in both languages. This finding suggests that the active role of the child when reading alone is important for developing phonological awareness.
4 General Discussion

4.1 Summary of findings

The first study of this thesis addressed the question of how Mandarin-speaking preschoolers develop various phonological awareness skills by examining the performance of children from age 4 to 6 on five Mandarin phonological awareness tasks. The results confirmed that the development of phonological awareness in Mandarin-speaking children, as in English-speaking (Treiman & Zukowski, 1991) and Cantonese-speaking children (Ho & Bryant, 1997b), progresses gradually from the awareness of relatively larger segments (e.g., syllables) to the awareness of smaller ones (e.g., onset-rime). Mandarin-speaking children are able to develop advanced syllable and tone awareness before entering school, but the development of onset-rime awareness may require further reading instruction. Their significant improvement in onset-rime combination skill after learning Pinyin indicates that reading instruction facilitates the development of onset-rime awareness in Mandarin.

The information about the development of phonological awareness in Mandarin monolingual children from Study 1 enables us to identify an effect of bilingualism on Mandarin phonological awareness. The second study of this thesis addressed the question of whether there is a true bilingual advantage in phonological awareness for Mandarin-English bilingual children. Bilingual children's phonological awareness skills were tested in both languages. The stronger and weaker languages of the bilingual children were identified by comparing their performance on the Chinese PPVT with that on the English PPVT. The comparison between bilingual children and two groups of monolingual children on phonological awareness performance
revealed that bilingual children demonstrate superiority on phonological awareness skills in both languages. This result not only confirmed that there is a bilingual advantage in phonological awareness but also indicated that this bilingual advantage exists in both the stronger and the weaker language of bilingual children.

4.2 Implications

Research aimed at examining the development of phonological awareness has mainly focused on alphabetic languages (see Gombert, 1992, for a review). The current study is the first to systematically investigate the development of phonological awareness in Mandarin. The general developmental profile of Mandarin-speaking children observed in this study enriches our understanding of the development of phonological awareness in general. The findings of the relative skill level in each phonological awareness domain of Mandarin can provide clinicians and educators in Mainland China with important information about children's development of phonological awareness in Mandarin. In addition, the phonological awareness measures developed for this study can be a useful tool for SLPs and educators working with Mandarin-English bilingual children in Canada. Clinicians in Canada encounter situations in which they need to make judgments about whether a bilingual child's problems in English are due to language difference or a true language disorder (Genesee, Paradis, & Crago, 2004). Many bilingual children cannot be assessed in English due to their limited English proficiency. Therefore, assessing bilingual children's phonological awareness in their native language can be the only solution for this clinical issue. Moreover, it has been established in previous and current research that phonological awareness developed in one language can be transferred to another
language, and it is an important predictor for reading acquisition in both native language and second language (Durgunoglu, Nagy, & Hancin-Bhatt, 1993; Comeau, Cormier, Grandmaison, & Lacroix, 1999; Gottardo, Siegel, Yan, & Wade-Woolley, 2001; Chow, McBride-Chang, & Burgess, 2005). Therefore, the information gathered about bilingual children’s phonological awareness abilities in their native language will help clinicians predict these children’s literacy acquisition in both languages and guide clinicians to provide appropriate intervention to bilingual children.

To examine bilingual advantages in phonological awareness, previous studies have mainly focused on one of the two languages of bilingual children (Bruck & Genesee, 1995; Yelland, Pollard, & Mercuri, 1993; Chen, Anderson, Li, Hao, Wu, & Shu, 2004). The current study is unique in investigating the effects of bilingualism on phonological awareness in both languages in bilingual children. Because bilingual children acquire better phonological awareness skills in both languages, they are more ready to learn to read in these two languages than monolinguals. However, they are only taught to read English in Vancouver. It is questionable whether bilingual children can maintain the advantage in phonological awareness for an extended period of time. Further longitudinal or cross-sectional studies including school-aged children are required to answer this question. The positive results from bilingual programs in other languages have indicated that children can acquire biliteracy in the context of immersion bilingual programs (Cummins, 1983). In addition, parents of the bilingual children in this study expressed great concern about their children’s loss of their native language. Therefore, I believe that Chinese-English bilingual programs would provide the best environment to these bilingual children.
4.3 Limitations

The cross-sectional research design of this study does not take the influence of individual differences in development into consideration. It cannot document the progression of an individual child through developmental stages. Therefore, clinicians need to be cautious in using the conclusions from this study for any individual child. The findings from this study can only provide a general picture of phonological awareness in Mandarin monolingual and Mandarin-English bilingual children. Longitudinal studies are required in the future to address individual differences in the development of phonological awareness in Mandarin monolingual and Mandarin-English bilingual children.

In conclusion, it is important for educational policymakers to understand monolingual and bilingual language development in order to decide which programs will best fit the needs of these children. Knowing how the language development of monolingual children differs from that of bilingual children is critical for clinicians and educators to provide appropriate intervention to each group of children.
References


phonological segments and reading ability in Italian children. *Applied Psycholinguistics, 9*, 1-16.


Fox, B., & Routh, D.K. (1975). Analyzing spoken language into words, syllables, and


Leong, C. K. (1986). What does accessing a morphemic scripts tell us about reading and


*Xinhua Dictionary (10th edition)*. China: Commercial Press.


Appendix A

Tone Discrimination

Instructions: Please listen to the tape. Each time you will hear three words. They will be repeated once. Please tell me which word sounds different, the first, the second or the third?

Practice:
1. (a) 撼 4 (b) 喊 3 (c) 汉 4-------------- (b)
2. (a) 方 1 (b) 芳 1 (c) 放 4-------------- (c)

Test:
1. (a) 莲 2 (b) 惜 2 (c) 炼 4-------------- (c)
2. (a) 路 4 (b) 腹 4 (c) 庐 2-------------- (c)
3. (a) 额 2 (b) 鹅 2 (c) 恶 3-------------- (c)
4. (a) 困 4 (b) 昆 1 (c) 坤 1-------------- (a)
5. (a) 雨 3 (b) 汀 1 (c) 语 3-------------- (b)
6. (a) 墨 4 (b) 抹 3 (c) 陌 4-------------- (b)
7. (a) 若 1 (b) 麻 2 (c) 抹 1-------------- (b)
8. (a) 衣 1 (b) 椅 3 (c) 医 1-------------- (b)
9. (a) 孔 3 (b) 控 4 (c) 恐 3-------------- (b)
10. (a) 穿 1 (b) 船 2 (c) 传 2-------------- (a)
11. (a) 油 2 (b) 有 3 (c) 友 3-------------- (a)
12. (a) 悲 1 (b) 背 4 (c) 备 4-------------- (a)

分数(Score): __________/12
# Appendix B

## Syllable Deletion

**FEEDBACK:** If the child makes an error, supply the correct answer on the practice items.

**SCORING:** Record correct answers as 1 and incorrect answers as 0.

**DIRECTIONS:** Say, “Let’s play a word game.”

### PRACTICE ITEMS:

- **a.** Say xiao3 peng2 you3. Now say xiao3 peng2 you3 without saying xiao3. If correct say, ”That’s right. Let’s try the next one.” If incorrect say, “That’s not quite right. Xiao3 peng2 you3 without saying xiao3 is peng2 you3.” Continue to give correct/incorrect feedback as before. Say, “Let’s try some more.”
- **b.** Say fei1 jil1. Now say fei1 jil1 without saying jil1.
- **c.** Say ping2 guo3. Now say ping2 guo3 without saying ping2.

### TEST ITEMS: Provide no feedback.

<table>
<thead>
<tr>
<th>Correct Response</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1/0)</td>
<td></td>
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</tbody>
</table>

2. Say xiong2 mao1. Now say xiong2 mao1 without saying mao1. xiong2 ______
4. Say lao3 shi1. Now say lao3 shi1 without saying lao3. shi1 ______
5. Say dan4 gao1. Now say dan4 gao1 without saying dan4. gao1 ______
6. Say hu2 die2. Now say hu2 die2 without saying die2. hu2 ______
7. Say dian4 shi4 jil1. Now say dian4 shi4 jil1 without saying jil1. dian4 shi4 ______
8. Say chang2 jing3 lu4. Now say chang2 jing3 lu4 without saying chang2. jing3 lu4 ______
9. Say tu2 hua4 shu1. Now say tu2 hua4 shu1 without saying hua4. tu2 shu1 ______
10. Say qianl bi3 he2. Now say qianl bi3 he2 without saying qianl. bi3 he4 ______
11. Say bing1 qi2 lin2. Now say bing1 qi2 lin2 without saying lin2. bing1 qi2 ______
12. Say shao1 mi3 fan4. Now say shao1 mi3 fan4 without saying mi3. shao1 fan4 ______
14. Say dian4 bing1 xiang1. Now say dian4 bing1 xiang1 without saying bing1. dian4 xiang1 ______
15. Say chi1 wan3 fan4. Now say chi1 wan3 fan4 without saying chi1. wan3 fan4 ______

**Total Raw Score** ______ /15
Appendix C
Onset-Rime Combination

MATERIAL: MP3 player

NOTE: If the child asks you to repeat the sounds, you may play the recorded sounds one more time.

PROMPT: If the child says the sounds separately (e.g., m-e, rather than me), prompt by saying, “Try to say the sounds all together as a real word.” This prompt can be used as often as needed on practice words only.

FEEDBACK: Give feedback on all practice items.

SCORING: Record correct answers as 1 and incorrect answers as 0.

PRACTICE ITEMS: Say, “Listen to the MP3 player. You will hear some words in small parts, one part at a time. I want you to listen carefully, and then put parts together to make a whole word. Ready? Let’s try one.”

a. Play the recorded instruction that says, “What word do these sounds make? b-a.” Then pause to allow the child to answer.

If correct say, ”That’s right. Let’s try the next one.”

If incorrect say, “That’s not quite right. When you put b-a together, it makes ba. You try it: b-a makes ______ ? (Pause.) Let’s try the next one.”

Continue the recorded items listed below, pausing after each item, and give corrective feedback as above.

Correct Response

b. What words do these sounds make? h-u-a hua
c. What words do these sounds make? s-an san
d. What words do these sounds make? t- ui tui
e. What words do these sounds make? d-ong dong
f. What words do these sounds make? m- ao mao

TEST ITEMS: Say, “Let’s try some more words. Each time you will hear the word one part at a time. Listen carefully and put the parts together to make a whole word.” (Continue the recorded items below, pausing after each item.) Items may be repeated once. Provide no feedback.

Correct Response

Score (1/0)

1. j- i ji
2. l- a la
3. t- ong tong
4. b- ei bei
5. d- ao dao
6. z- ou zou
7. p- ing ping
8. c h- e che
9. c- ai cai
10. m- an man
11. g- u- a gua
12. x- i- a xia
Appendix D

Initial Sound Identification

MATERIALS: Picture Book

NOTE: Items can be repeated once if child appears to forget names. For practice and test items, pause 1 second after pronouncing the target word before pronouncing the two alternative answers.

FEEDBACK: Give feedback on all practice items.

SCORING: Record correct answers as 1 and incorrect answers as 0.

PRACTICE ITEMS: Say , “We’re going to play a game with words.”

a. Which words start with the /b/ sound like bei? bao, cai or hei?
   If correct say, ”That’s right; bei and bao start with the same sound, /b/. Let’s try the next one.”
   If incorrect say, “That’s not quite right. The answer is bao, because bei and bao (emphasize the first sound) start with the same sound, /b/. Let’s try another one.”
   Continue correct/incorrect feedback as above.

Correct Response

b. Which word starts with the /n/ sound like niu? hua, niao or qiu? niao

c. Which word starts with the same sound as fang? tang, san or fan fan

TEST ITEMS: Provide no feedback.

<table>
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<th>Score</th>
<th>Correct Response</th>
<th>(1/0)</th>
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<tbody>
<tr>
<td></td>
<td>1. Which word starts with the same sound as dao? mian, deng or tao? deng</td>
<td></td>
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<tr>
<td></td>
<td>2. Which word starts with the same sound as hai? gai, wan or hong? hong</td>
<td></td>
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<tr>
<td></td>
<td>3. Which word starts with the same sound as ku? dan, kou or gu? kou</td>
<td></td>
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<td></td>
<td>4. Which word starts with the same sound as lan? long, shan or ren? long</td>
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<tr>
<td></td>
<td>5. Which word starts with the same sound as mao? cao, tou or ma? ma</td>
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<tr>
<td></td>
<td>6. Which word starts with the same sound as pa? pan, bao or ba? pan</td>
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<td></td>
<td>7. Which word starts with the same sound as suo? zou, san or guo? san</td>
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<td>8. Which word starts with the same sound as tong? tang, zhong or shu? tang</td>
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<td>9. Which word starts with the same sound as xia? xing, jia or qiang? xing</td>
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</tr>
<tr>
<td></td>
<td>10. Which word starts with the same sound as chi? zheng, mi or che? che</td>
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</table>

Total Raw Score /10
Appendix E
Rhyme Detection

Instructions: Please listen to the tape. Each time you will hear three words. They will be repeated once. Please tell me which word doesn’t rhyme, the first, the second or the third?

Practice: 1. (a) 杯[bei1] (b) 山[shan1] (c) 烟[yan1]-----------------(a)
2. (a) 图[tu2] (b) 无[wu2] (c) 林[lin2]-----------------(c)

Test:
1. (a) 是[shi4] (b) 系[xi4] (c) 过[guo4]-----------------(c)
2. (a) 滩[tan1] (b) 青[qing1] (c) 晶[jing1]-----------------(a)
3. (a) 被[bie3] (b) 撒[pie3] (c) 血[xue3]-----------------(c)
4. (a) 小[xiao3] (b) 巧[qiao3] (c) 北[bei3]-----------------(c)
5. (a) 坏[huai4] (b) 线[xian4] (c) 变[bian4]-----------------(a)
6. (a) 谎[huang3] (b) 疏[chun3] (c) 准[zhun3]-----------------(a)
7. (a) 欢[huan1] (b) 香[xiang1] (c) 枪[qiang1]-----------------(a)
8. (a) 太[tai4] (b) 破[po4] (c) 卖[mai4]-----------------(b)
9. (a) 无[wu2] (b) 头[tou2] (c) 足[zu2]-----------------(b)
10. (a) 修[xiu1] (b) 灰[hui1] (c) 秋[qi1]-----------------(b)
11. (a) 张[zhang1] (b) 灯[deng1] (c) 康[kang1]-----------------(b)
12. (a) 瓜[gua1] (b) 兄[xiong1] (c) 花[hua1]-----------------(b)
13. (a) 虫[chong2] (b) 霞[xia2] (c) 同[tong2]-----------------(b)
14. (a) 哈[ha1] (b) 猫[mao1] (c) 发[fa1]-----------------(b)
15. (a) 声[sheng1] (b) 区[qu1] (c) 风[feng1]-----------------(b)

分数(Score): ________/15
Appendix F

The University of British Columbia
Office of Research Services
Behavioural Research Ethics Board
Suite 102, 6190 Agronomy Road,
Vancouver, B.C. V6T 1Z3

CERTIFICATE OF APPROVAL - FULL BOARD

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INSTITUTION(S) WHERE RESEARCH WILL BE CARRIED OUT:

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Other locations where the research will be conducted:
Elementary schools in Greater Vancouver; Bilingualism Research Lab, IRC B4E, UBC Department of Child Behavior and Development, Shanghai Children's Medical Centre, Shanghai, China.

CO-INVESTIGATOR(S):
Jing Zhao

SPONSORING AGENCIES:
Natural Science Engineering Research Council

PROJECT TITLE:
Phonological Awareness in Chinese Monolingual and Chinese-English Bilingual Children

REB MEETING DATE: January 25, 2007
CERTIFICATE EXPIRY DATE: January 25, 2008

DOCUMENTS INCLUDED IN THIS APPROVAL:

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<tr>
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The application for ethical review and the document(s) listed above have been reviewed and the procedures were found to be acceptable on ethical grounds for research involving human subjects.

Approval is issued on behalf of the Behavioural Research Ethics Board and signed electronically by one of the following:

Dr. Peter Suedfeld, Chair
Dr. Jim Rupert, Associate Chair
Dr. Arminee Kazanjian, Associate Chair
Dr. M. Judith Lynam, Associate Chair