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Phonological awareness in Cantonese-English bilingual preschool children

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Abstract

This study examined the effect of bilingualism on phonological awareness. The phonological awareness of 30 Cantonese-English bilinguals and 30 Cantonese monolinguals whose chronological age between 4; 00 to 5; 05 were compared. Four areas of phonological awareness were assessed: syllable awareness, rhyme awareness, phoneme awareness and tone awareness. The Cantonese-English bilinguals showed similar scores of syllable, rhyme and phoneme awareness to their monolingual peers, but bilinguals showed better tone awareness than monolingual peers. Syllable and rhyme awareness in these children improved with increasing age. It was found that tone awareness emerged before syllable awareness, which emerged before rhyme awareness, which in turn emerged before phoneme awareness. It is concluded that bilingualism does not facilitate development of phonological awareness. The findings are discussed in light of previous research on the influence of the orthography learned, the language dominance in bilingualism, and types of language learning exposure.

Literature review on bilingualism and phonological awareness

There were a number of research findings concerning the relationship between bilingualism and phonological awareness (Bruck & Genesee, 1995; Burt, Holm, & Dodd, 2001; Bialystok, Majumder, & Martin, 2003). According to de Houwer (1995), bilingualism was defined as the consequence of exposure to two languages. Bilinguals should show some knowledge and control in two languages (Skutnabb-Kangas, 1984 cited in Hoffmann, 1991), and they should be able to use both languages in most situations.

There were two types of bilinguals. The first type is *bilingual first language acquisition*, which means children who are exposed to two languages since, or within one month after birth. The second type, known as *bilingual second language acquisition*, refers to children who are exposed to a second language after one month of birth, but before the age of two. The differences in pattern of language acquisition in these two types of bilinguals has not been clearly studied (de Houwer, 1995). In addition, types of language spoken by parents, school and community, language dominance and proficiency of each language play important roles in acquisition phonology in bilingual children (de Houwer, 1995; Hoffmann, 1991).

The relationship between bilingualism and phonological awareness has generated a number of researches in recent years (Bruck & Genesee, 1995; Campbell & Sais, 1995; Chen et al., 2004). According to Bruck and Genesee (1995), phonological awareness has been defined as a person's insight about the sound structure of a language and his/her ability to manipulate sound units. They suggested that there were typically three components of phonological awareness: syllable awareness, rhyme awareness and phoneme awareness. Phonological awareness of Cantonese also includes also tone awareness as Cantonese is a tonal language (Chen, Anderson, Li, Hao, Wu, & Shu, 2004). It has been suggested that tone awareness is an important area of study in research on phonological awareness in Cantonese (Gottardo, Siegel, Yan, & Woolley, 2001).

Early research of Bruck and Genesee (1995) and Campbell and Sais (1995) suggested that bilingualism facilitated phonological awareness in pre-school children. Bruck and Genesee (1995) concluded that French-English bilinguals outperformed English monolinguals in syllable awareness and onset-rhyme segmentation, but not in phoneme awareness. They suggested that advanced syllable awareness in French-English bilingual children was attributed to the relative saliency of syllables in French.

In another study by Campbell and Sais (1995), five-year-old English-Italian bilinguals were shown to perform better on a syllable deletion task than their monolingual English peers. The finding was explained by that fact that the Italian language has a more systematic syllabic and phonological structure than English. The above studies indicate that the characteristics of phonological systems of languages influence the phonological awareness in bilinguals.

Loizou and Stuart (2003) also reported a study that partially supports this conclusion. They found that the relative phonological complexity of two languages affects levels of phonological awareness. Successive English-Greek bilinguals (who were first exposed to English and learned Greek as a second language) outperformed English-speaking monolinguals in phoneme awareness, though the groups did not differ in syllable and rhyme awareness. However, similar abilities in syllable, rhyme and phoneme awareness were found in successive Greek-English bilinguals (who were first exposed to Greek and learned English as a second language) and monolingual Greek children. Loizou & Stuart (2003) concluded that the *bilingual enhancement effect,* which can only be found in bilingual children whose second language is phonologically simpler than their first language. As Greek was judged to be a phonologically simpler language than English (Loizou & Stuart, 2003), English-Greek bilinguals showed better phonological awareness than English-speaking monolinguals.

In addition, Chen et al. (2004) reported that Cantonese-Mandarin bilinguals developed a higher level of rhyme and onset awareness by second grade after they learnt Pinyin, but the difference in their phonological awareness disappeared by fourth grade. Pinyin refers to the representation of Chinese speech sounds by alphabets that code the sounds of the words. Furthermore, first grade Cantonese-Mandarin bilinguals performed better in tone awareness than their monolingual Mandarin speaking peers, as the tonal system in Cantonese was more complex than that in Mandarin (Chen, et al., 2004). It was concluded that bilingualism promoted phonological awareness in Cantonese-Mandarin bilinguals. However, it was difficult to isolate the effect of Pinyin on advanced phonological awareness in the bilingual group in this study. The advanced phonological awareness in Cantonese-Mandarin bilinguals might be due to bilingualism and Pinyin learning.

The studies reviewed so far suggest that bilingualism facilitates phonological awareness. Other research studies however have found that bilingualism does not facilitate the development of phonological awareness (Jackson, Holm, & Dodd, 1998; Bialystok et al., 2003). Jackson et al. (1998) reported that Cantonese-English bilinguals and English-speaking monolinguals performed equally well in syllable and phoneme awareness tasks, but the bilinguals showed a lower level of rhyme awareness than the monolinguals. It was shown that learning two languages did not lead to an enhanced phonological awareness in these children.

Bialystok et al. (2003) suggested that advanced levels of phonological awareness in bilingual children were not due to bilingualism. The research result showed that Spanish-English bilinguals showed the highest level of phoneme awareness, English-speaking monolinguals came second, while Cantonese-English bilinguals showed the lowest level of phoneme awareness among three groups of children. This showed that bilingualism did not facilitate phonological awareness, because Spanish-English bilinguals performed better than Cantonese-English monolinguals. Three possible explanations for the finding were offered:

differences in proficiency in the bilingual children's languages; differences in the complexity of the phonological systems being acquired and the nature of the orthography being acquired. The above studies have shown that there were inconsistent results on the relationship between bilingualism and phonological awareness, the examinations of phonological awareness in Cantonese-English bilinguals in this study will verify the significance of bilingualism in phonological awareness.

Previous research has indicated that the type of orthography learned influences phonological awareness. There is a strong link between literacy development in alphabetic language and phonological awareness (McCormick, 1995, Burt et al. 2001). Generally speaking, learning of an alphabetical script facilitates the development of phoneme awareness (Bruck & Genesee, 1995; Holm & Dodd, 1996; Loizou & Stuart, 2003). Investigation of phonological awareness in Cantonese-English bilinguals will verify if learning an alphabetical language in bilingualism can facilitate development of phonological awareness.

Phonological awareness contributes to the development of literacy in alphabetical languages (Wagner, Torgesen, & Rashotte, 1994, cited in Bialystok et al., 2003). Alphabetical languages show explicit correspondence between graphemes and phonemes (Bialystok, Luk, & Kwan, 2005), teaching grapheme-to-phoneme correspondence helps children to be more aware of phonemes and develop reading abilities.

Furthermore, there is evidence showing a close relationship between phonological awareness and acquisition of literacy in tonal language systems (Ho & Bryant, 1997b; Chow, Mc-Bride-Chang, & Burgess, 2005). Ho & Bryant (1997b) reported that onset and rhyme awareness are significant indicators of Chinese reading ability in monolinguals.

In addition, Gottardo, Siegel, Yan, & Wade-Woolley (2001) studied the roles of phonological skills (rhyme detection and tone awareness) in Chinese on English reading abilities. The results suggested that Cantonese rhyme detection was correlated with English

reading abilities in Chinese-English bilinguals. Chow et al. (2005) also reported that syllable deletion was a good predictor of Chinese and English reading abilities in Cantonese-English bilinguals. These studies suggest that phonological awareness in a non-alphabetical language also contributes to reading abilities in an alphabetical language. If phonological awareness in Cantonese is a predictor of reading in Chinese and English, it is essential to investigate phonological awareness in Cantonese-English bilingual children and to establish normative data of phonological awareness.

Purposes of study

There are two purposes in this study. Firstly, it will investigate the relationship between bilingualism and phonological awareness. The study will compare the phonological awareness of Cantonese-English bilinguals and Cantonese-speaking monolinguals. The information will help us understand how bilingualism affects phonological awareness in tonal languages, providing normative data for speech therapists who work with Cantonese-English bilingual children. Secondly, this study will explore the effect of age on the development of phonological awareness in Cantonese-English preschool bilingual children.

Research questions and hypotheses

1. Do Cantonese-English bilingual children show similar levels of phonological awareness to monolingual Cantonese-speaking children? It is hypothesized that Cantonese-English bilinguals will perform at similar levels as Cantonese-speaking monolinguals. They will show similar scores in syllable awareness, rhyme awareness, phoneme awareness and tone awareness.

2. Do components of phonological awareness improve with increasing age in 4; 00 to 5; 05 children? It is hypothesized that the syllable awareness and rhyme awareness of both groups of children will improve with age. The tone awareness and phoneme awareness will not improve with increasing age in 4; 00 to 5; 05 children.

3. What is the order of development of different components of phonological awareness*?* It is hypothesized that tone awareness will emerge before syllable awareness, which will emerge before rhyme awareness, which in turn will emerge before phoneme awareness in Cantonese-English preschool bilinguals.

Method

Participants

The study recruited 60 normally developing children whose chronological ages ranged from 4; 00 to 5; 05. The children were categorized into two groups by language exposure, 30 Cantonese-English bilinguals were in one group, and 30 Cantonese-speaking monolinguals were in another group. The children were categorized into sub-groups by chronological age (Table 1 and Table 2). Each bilingual child was matched with a monolingual peer on the basis of chronological age and gender. The age difference in each pair was less than two months. Monolingual Cantonese-speaking children served as controls, so that phonological awareness of bilingual children could be compared.

Table 1

Age and gender distribution of bilingual participants

Age group	n	Number of male	Number of female	Mean age (SD) (year; month) (month)
4; 00 – 4; 05	10	5	5	4; 03 (1.50)
4; 06 – 4; 11	10	4	6	4; 07 (1.62)
5; 00 – 5; 05	10	5	5	5; 02 (1.74)

Table 2

Age and gender distribution of monolingual participants

Age group	n	Number of male	Number of female	Mean age (SD) (year ; month) (month)
4; 00 – 4; 05	10	5	5	4; 03 (1.04)
4; 06 – 4; 11	10	4	6	4; 08 (1.80)
5; 00 – 5; 05	10	5	5	5; 03 (1.69)

All the participants in the research satisfied the following criteria. Firstly, no hearing loss, visual impairment, cognitive impairment, or physical impairment was reported by the parents. Secondly, the participants did not have any noted articulation or phonological disorder. Thirdly, the participants did not receive any training in English pronunciation or Mandarin Pinyin. Lastly, no other language was commonly used at home or school, because phonological awareness could be affected by exposure to the English pronunciation system and/or the phonological system of other languages (Valtin, 1984, cited in Wong, 1997).

The bilingual participants were successive bilinguals. Cantonese was the dominant language in these bilingual children. The bilingual children were exposed to English for at least four hours a day (Table 3). They studied in English-language schools, so they were fluent in English. The children spoke Cantonese to at least one parent, so they were also fluent in Cantonese.

The monolingual children were attending Cantonese-speaking kindergartens. All the children spoke Cantonese to their parents at home and peers at schools. Though there were English classes in kindergarten, the daily exposure to English was less than one hour, so they were not Cantonese-English bilinguals (Table 3).

Table 3

Duration of daily English and Chinese exposure of bilinguals and monolinguals

Age group	Bilinguals (Exposure to English) (hours)	Bilinguals (Exposure to Chinese) (hours)	Monolinguals (Exposure to English) (hours)	Monolinguals (Exposure to Chinese) (hours)
4; 00 – 4; 05	5.70	8.20	0.85	11.30
4; 06 – 4; 11	5.50	9.30	0.73	11.90
5; 00 – 5; 05	5.30	7.20	1.00	12.00

Recruitment of participants

The study recruited bilingual participants from international kindergartens or Anglo-English kindergartens in Hong Kong. The bilingual children were exposed to English for at least four hours in school a day. The monolingual controls were recruited from local kindergartens in Hong Kong, and the medium of instruction was Cantonese. Consent forms and questionnaires were distributed to parents. Questionnaires helped to screen if the children were bilinguals and gave an understanding of their language exposure. The questionnaires also helped to identify if the children had participated in English pronunciation class.

Procedures

Each bilingual child received one 80-minute session with the examiner. Each monolingual child received one 60-minute session with the examiner. All participants were first screened with the Cantonese version of the Reynell Developmental Language Scales (Reynell, 1987). Bilingual participants were tested with the PPVT-R. Tests on phonological awareness commenced only if the children passed the language screening. The examiner randomized the order of the phonological awareness tasks to ensure that the order of presentation did not affect the results of the phonological awareness tests.

Measures

Screening tests

All children received screening tests of Cantonese language ability. The Cantonese language ability of children was screened using the Cantonese version of the Reynell Developmental Language Scales (Reynell, 1987). The examiner administered this test to all participants. Children who scored -1.0 standard deviations below the mean on receptive and expressive language were not recruited as participants, because they were suspected to have language delay which may negatively affect their phonological awareness (Wong, 1997).

The Cantonese-English bilinguals received additional tests of their English language ability. The bilingual participants were tested by Peabody Picture Vocabulary Test-Revised (PPVT-R) (Dunn & Dunn, 1981), which tested their English receptive vocabulary. It also tested the general English ability of the children and checked if the participants were bilingual (Bialystok et al., 2003). The age-equivalence of PPVT-R for bilingual children was within 1.5 years of their chronological age. A relatively loose criterion is used for bilinguals because they usually have lower PPVT-R scores (Bialystok, 1988, cited in Bialystok et al., 2003, p.40).

Phonological awareness tests

The phonological awareness tests were comprised of seven informal tasks which were adopted from Kam (1996) and Wong (1997). The length and linguistic complexity of the test instructions were kept short and carefully controlled, so that all the participants were able to understand the test instructions. In the rhyme detection task, phoneme detection task and phoneme identification task, the question word, target word and distractors were presented verbally and in photographic format to minimize memory load.

In each informal task, two practice items were given first. Specific feedback was given after the participant answered the practice items. This helped participants understand the informal tasks. Neutral feedback was given for the actual test items.

Syllable counting. Before counting the syllables, the child's counting ability was tested. All participants were given four pictures with different numbers of objects. There number of objects was always less than five. Participants continued the syllable counting task only if they were able to count the number of pre-task objects with at least 75% accuracy (3/4). Six words were tested and the participants were required to count the number of syllables in each word. There were one to four syllables in each word.

Syllable detection. Six words were tested. There were one to three syllable(s) in each word. The participant was asked to answer what syllable(s) was/were remained when one to two syllable(s) in a word was/were deleted according to the examiner's instruction.

Rhyme deletion. There were six test items in this task. The examiner presented the words verbally. The participant was asked to choose a word with the same rhyme as the target word from three choices.

Tone detection. There were eighteen test items in this task. The examiner read aloud a pair of words, the participant then decided if the two spoken words had the same tone.

Phoneme detection. There were six questions in this task. In each question, two of the three words had the same initial phoneme. The examiner read aloud the three words. The participant was asked to choose the spoken word with a different initial phoneme from the other two words.

Phoneme identification. Six single words were tested in this task. Three pictures of animals representing three initial phonemes, /m/, /h/ and /s/ were introduced. The participant was asked to identify the initial phoneme of each spoken word produced by the examiner by pointing to the appropriate animal.

Phoneme production. Six initial consonants were used as test stimuli. Two examples of words with the same initial phoneme were presented to help participants understand the

task. The participant was asked to produce a word with the same initial phoneme as that presented by the examiner.

Appendix A contains full details of all phonological test tasks.

Tests of reliability

Ten percent of the data (three children from monolingual group and three children from bilingual group) on phonological awareness was re-collected by another examiner. The test re-test reliability was calculated using percentage of agreement. The test-retest reliability was 98.1% accuracy. The same examiner checked ten percent of the data after one week of data collection again for intra-rater reliability. The intra-rater reliability was calculated by percentage of agreement. The intra-rater reliability was 100%.

Result

Comparison of bilingual and monolingual children

A two-way repeated measure ANOVA for language (2) and age (3) was conducted for each phonological awareness test. It determined if the bilingual children performed differently from monolingual children and if age affected phonological awareness of these children. As shown in Figure 1, the bilinguals showed similar performance as monolinguals in all phonological awareness tasks. Besides phoneme detection and production, percentages of accuracy in other phonological awareness tasks seemed to improve with increasing age.

Comparison of tasks (phonological awareness at different levels)

The study assessed four components of phonological awareness, which were tone, syllable, rhyme and phoneme. Syllable awareness summarized the performance in syllable counting and syllable deletion. Phoneme awareness summarized the performance in phoneme detection, phoneme identification and phoneme production.

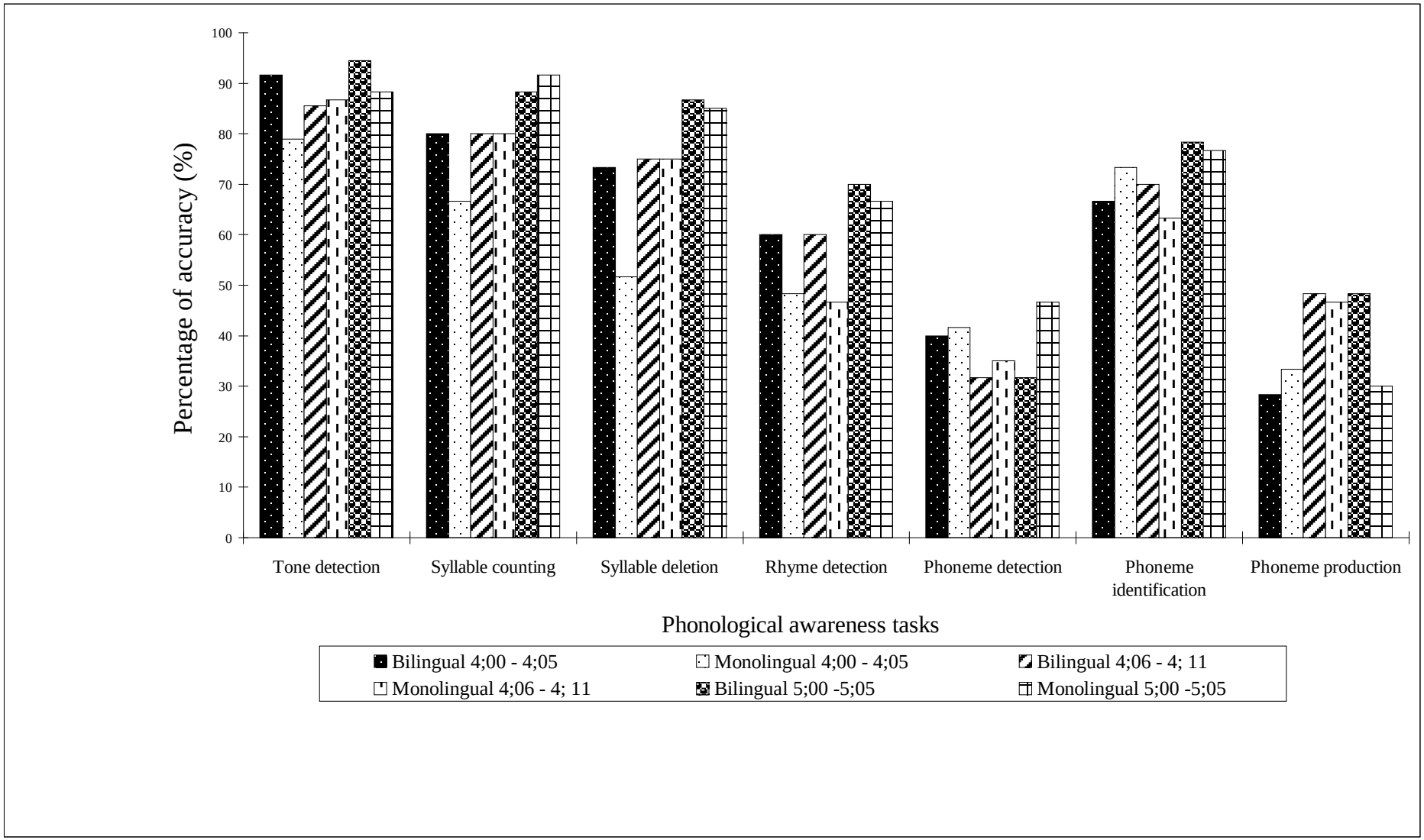

Figure 1. Mean percentage of accuracy of phonological awareness tasks in 4; 00 to 5; 05 bilinguals and monolinguals

As shown in Figure 1, the performance of phonological awareness for different components was observed. The mean percentage of accuracy for tone detection was highest, followed by syllable counting and syllable deletion, rhyme detection and phoneme identification. The mean percentage of accuracy for phoneme detection was lowest among all tasks. Therefore, awareness of syllables and tones were developed first in Cantonese-English bilinguals and Cantonese monolingual children, followed by rhyme awareness. Phoneme awareness was not developed in Cantonese-English bilingual preschool children.

By comparing percentages of accuracy in phoneme detection and phoneme identification tasks, bilingual children showed a lower percentage of accuracy in phoneme detection than phoneme identification (Figure 1), and a significant difference in phoneme detection task and phoneme identification task was observed, $t(118) = -7.78$, $p < .01$. Therefore, both groups of children performed significantly poorer in phoneme detection than phoneme identification task.

Table 4 in page 16 presents the analysis of variance for different phonological awareness tasks. Generally, the bilingual group performed at a similar level as the monolingual group for most phonological awareness tasks, including syllable awareness, rhyme awareness and phoneme awareness task, but the bilingual participants showed better performance than monolingual participants in tone detection, $F(1, 27) = 6.20$, $p < .05$. In addition, there was significant age effect on syllable counting, syllable deletion and rhyme detection. However, there was no significant effect of age or language for phoneme detection, phoneme identification and phoneme production tasks. Effects of interaction for age and language were not found for any tasks.

Table 4

Analysis of variance for different phonological awareness tasks

Independent variable	Age		Language	
Tasks	F (2, 27)	Level of significance	F (1, 27)	Level of significance
Syllable counting	3.99 *	p < .05	0.66	p = .43
Syllable deletion	6.58 **	p < .01	2.41	p = .13
Rhyme detection	3.92*	p < .05	3.12	p = .09
Tone detection	2.25	p = .13	6.20*	p < .05
Phoneme detection	0.51	p = .61	1.72	p = .21
Phoneme identification	0.82	p = .45	0.01	p = .93
Phoneme production	2.07	p = .15	0.63	p = .44

* p < .05 ** p < .01

Syllable counting

Results showed that age significantly affected syllable counting, but there was no significant difference between bilinguals and monolinguals. Post-hoc Tukey tests indicated that the age group 4; 00 to 4; 05 was different from the age group 5; 00 to 5; 05 (p < .05). Therefore, children in the age group 5; 00 to 5; 05 was superior to children in the age group 4; 06 to 4; 11 in this task.

Syllable deletion

There was significant effect of age on syllable deletion. No significant difference was found in bilinguals and monolinguals (Table 4). Post-hoc Tukey test indicated that the age group 4; 00 to 4; 05 was different from the age group 5; 00 to 5; 05 (p < .01). Therefore, the performance of children in the age group 5; 00 to 5; 05 was better than children in the age group 4; 06 to 4; 11 in this task.

Rhyme detection

The results showed that age significantly affected the performance in rhyme detection. No significant effect of language on this task was found (Table 4). Tukey test indicated that the age group 4; 06 to 5; 00 was different from the age group 5; 00 to 5; 05 ($p < .05$). Therefore, children in the age group 5; 00 to 5; 05 showed better performances than children in the age group 4; 06 to 4; 11 in this task.

Tone detection

A significant effect of language on tone detection was observed, bilingual children showed better performance than monolingual controls. No significant age effect was found.

Further analysis of phoneme production task

The bilinguals and monolinguals showed a similar percentage of accuracy in phoneme production, the percentages of accuracy of these two groups were below 50%, they did not master phoneme production. Analysis of error patterns in the phoneme production task of bilingual children showed interesting results. The types of errors in the phoneme production task were classified into English errors, phonologically related errors, unrelated errors, others and no response (Appendix B, Table A1). The analysis result showed that the most prevalent error pattern was no response. The bilingual children made more English errors than monolingual children (Table 5).

Table 5

Percentages of types of errors by bilinguals and monolinguals in phoneme production

	Response pattern					
Group	Correct	English errors	Phonologically related errors	Unrelated errors	Other errors	No response
Bilingual	26.8%	17.8%	12.1%	20.6%	6.54%	42.9%
Monolingual	20.6%	5.22%	22.6%	21.7%	8.70%	41.7%

Discussion

The purpose of this study was to determine if bilingualism facilitated phonological awareness of children. It was hypothesized that bilingualism did not facilitate children's phonological awareness and Cantonese-English bilingual children showed similar scores of phonological awareness as Cantonese monolingual peers. The results of this study showed that the scores of syllable awareness, rhyme awareness and phoneme awareness between bilinguals and monolinguals did not show significant statistical differences. This finding suggested that Cantonese-English bilingualism did not promote development of phonological awareness of Cantonese.

Relationship between bilingualism and phonological awareness

The results of this research revealed that bilingual children and monolingual children showed similar scores of phonological awareness. For example, the bilingual children's mean score in syllable counting was not statistically different from monolingual children, $F(1, 27) = .66$ ($p = .42$). There were three possible explanations for the finding that Cantonese-English bilingualism did not facilitate acquisition of phonological awareness.

Natures of languages learned by bilinguals

Firstly, the nature of languages learned by the bilinguals influenced their levels of phonological awareness, especially phoneme awareness (Caravolas & Bruck, 1993; Bialystok et al., 2003; Chen et al., 2004). The nature of orthography (alphabetical or non-alphabetical) might be significant factors in the development of phonological awareness.

Alphabetical languages could be divided into transparent language and opaque language. Words in a transparent language such as Spanish showed unique grapheme-to-phoneme correspondence. English was an opaque language; correspondence of phoneme to grapheme is not always consistent (Gorman & Gillman, 2003). In contrast, the writing system

in Chinese (Cantonese) was logographic in nature, no *grapheme-to-phoneme correspondence* was present in Chinese orthography (Ho & Bryant, 1997b).

When children learned to read and write Chinese, they focused on the visual details such as radicals of words rather than the phonological information such as phonemes of words. Though Chinese phonetic radicals are found in Chinese logographs, but there were no direct phonological information revealed from the radical. The weak *grapheme-to-phoneme correspondence* in Cantonese may give rise to children's poor awareness of rhyme and phoneme. As a result, bilingual and monolingual children who learnt Chinese might show lower levels of rhyme and phoneme awareness compared to children who learnt an alphabetical language.

Chen et al. (2004) provided evidence that support the importance of alphabetical language on phonological awareness, Cantonese-Mandarin bilinguals who learnt Pinyin showed heightened onset and rhyme awareness compared to Cantonese counterparts. In addition, Bialystok et al. (2005) showed that bilingual children who learnt two alphabetical languages such as Spanish and English showed better performance than children who learned one alphabetical language, regardless of bilingual or monolingual children. Therefore, it was hypothesized that the nature of languages (alphabetical or non-alphabetical) learned by the bilingual children played a significant role in development of phonological awareness.

Duration of exposure to alphabetical language

Secondly, bilingual children who were more exposed to an alphabetical language might have stronger proficiency in that language relative to peers who had less exposure to that alphabetical language (Bialystok, 1988). The language proficiency in alphabetical language may positively affect the metalinguistic awareness of children (Bialystok, 1988; Bialystok et al., 2003). Phonological awareness was a type of metalinguistic awareness

(Eviatar & Ibrahim, 2000), the duration of exposure to an alphabetical language might indirectly affect phonological awareness in bilingual children.

The duration of exposure to English of Cantonese-English bilinguals in this study was less than six hours a day, who had a shorter exposure to English-speaking monolinguals. Shorter duration of English in the bilinguals might reduce their proficiency in English which indirectly negatively affect the phonological awareness of bilingual children. Beside, Bialystok (1988) suggested that the *level of bilingualism*, which referred to the proficiency in two languages contributed to the degree of metalinguistic awareness. The dominant language of bilingual participants in this study was Cantonese, and their exposure to English was of shorter duration than Cantonese, so they did not achieve similar scores of phonological awareness as English-speaking monolinguals. In addition, Bialystok et al. (2003) reported that Cantonese-English bilinguals showed lower level of phonological awareness compared with Spanish-English bilinguals, it was suggested that lower English ability in Cantonese-English bilinguals might explain lower phonological awareness. Therefore, it was hypothesized that only bilingualism was not sufficient for good phonological awareness, development of phonological awareness required certain level of proficiency in that language.

Another observation was noted in phoneme production task, with bilingual children making more English errors than monolingual children For example, some bilingual children produced an English word “sun” for the initial phoneme /s-/.) . It was hypothesized that Cantonese-English bilinguals might give English words as answers if they were not able to segment Cantonese words into phonemes. This is because phoneme segmentation in English was more explicit than Cantonese. When Cantonese-English bilingual children were asked to produce Cantonese words with a given initial consonant, processing of individual phonemes in Cantonese words may be necessary. However, the Cantonese characters were orthographically based rather than alphabetically coded. As a result, generations of English

words based on initial consonants was hypothesized to be easier than Cantonese words. The Cantonese-English bilingual children will thus easily produce English words instead of Cantonese words.

The method of language learning

Last but not least, the method of learning phonology may also affect the phonological awareness of children, especially phoneme awareness. The results of this study supported the argument that bilingual and monolingual children showed below chance level performance in phoneme detection and phoneme production task. An analysis of the phoneme production task revealed that both groups showed a large proportion of no response, this indicated that their abilities in segmentation and manipulation of phonemes were weak.

Hong Kong children learned to read Chinese characters using a whole-word learning method, they learnt words by reading the characters, with the meaning of characters were explained (Ho & Bryant, 1997b; Cheung, Chen, Lai, Wong, & Hills, 2001). English education in local and Anglo-Chinese kindergartens may also adopt this approach. The bilingual children in these kindergartens learnt the English words by rote. No instruction on segmenting phonemes when learning new English words was given (Ho & Bryant, 1997a). As the bilingual and monolingual children also adopted whole-word learning method in learning English and Chinese words, the adoption of whole-word learning resulted in the acquisition of Chinese characters based on visual characteristics rather than phonemes of Cantonese spoken words. Therefore, Cantonese-English bilingual children might be less skillful in segmentation of words and manipulation of phonemes compared with English-speaking monolingual children.

Effect of age on phonological awareness in Cantonese-English bilinguals

It was hypothesized that the Cantonese-English bilingual children showed improved syllable and rhyme awareness with increasing age. Analysis of the results showed that 5; 00

to 5; 05 children outperformed 4; 00 to 4; 06 children in syllable counting and syllable deletion, and 4; 06 to 4; 11 children outperformed 5; 00 to 5; 05 children in rhyme detection. In syllable counting, all children were able to count real objects with at least 75% accuracy before counting syllables, so failure in counting syllable could not account for the poorer performance in syllable counting in 4; 06 children. At about age four, the "metalinuistic development relates to a general change in *information-processing capability* that occurs during middle childhood" (Tunmer & Rohl, 1991, p2). They suggested that these changes to *information-processing capability* might help children to process phonological segments of language, so children may become increasingly aware of syllables and rhymes with age maturation.

Acquisition of phonological awareness in bilingual children

This study also showed that tone awareness before syllable awareness, which developed before rhyme awareness, which in turn developed before phoneme awareness in Cantonese-English bilinguals and Cantonese-speaking monolinguals. For example, 5; 00 to 5; 05 bilinguals and monolinguals had acquired tone and syllable awareness, but 4; 00 to 4; 05 children only acquired tone awareness.

Tone awareness was first developed because tone carried a high functional load in Cantonese, as changes in lexical tone lead to changes in lexical meaning. Cantonese speaking children mastered tone contrasts by age two (So & Dodd, 1995), so four-year-old bilingual and monolingual children had mastered tone processing skills for years, so they achieved high accuracy in tone awareness tasks. Bilingual children and monolingual children were able to discriminate tones with over 80% accuracy, indicated that both groups acquired tone awareness, the bilingual group showed ever better tone awareness than monolinguals. This suggested that the development of tonal awareness is independent on the bilingualism in Cantonese-English bilinguals.

Syllable awareness emerged first among syllable, rhyme and phoneme awareness in bilingual and monolingual children. This finding was consistent with Woo's (1993) finding on phonological awareness of Cantonese preschool children. Cantonese was a syllable-timed dialect, all syllables showed regular durations (Ladefoged, 2001). Also, syllables contained vowels that had higher loudness level compared with onsets and codas. The intense acoustic signals of syllables (intense signals corresponded to vowels of syllables) provided acoustic cues in syllable awareness tasks (Ladefoged, 2001); therefore syllable awareness tasks were easier than rhyme and phoneme awareness for bilingual children.

Rhyme awareness emerged before phoneme awareness in bilingual children. There were two possible reasons for this finding. Firstly, rhymes were more perceptually salient than phonemes (Wong, 1997), so it was easier to detect rhyme than phonemes. Secondly, children might judge whether two words rhyme based on the phonological similarity of two words (Morais, Bertelson, Carys, & Alegia, 1986, cited in Wong, 1997), so they might show higher accuracy in rhyme awareness than phoneme awareness using this strategy.

The results of this study also showed that rhyme awareness was emerging in five-year-old monolingual and bilingual children, as they achieved about 70% accuracy in rhyme awareness task in this study. This result was also consistent with Woo's (1993) findings. These two studies reported that 5; 00 Cantonese-speaking children showed better abilities in syllable awareness than rhyme awareness.

Nevertheless, this study showed that phoneme awareness was not developed in 5; 00 children; this finding was inconsistent with previous studies of phoneme awareness in Cantonese preschool children (Woo, 1993). Woo (1993) reported that both phoneme awareness seemed to emerge in 5; 00 Cantonese monolinguals, but 5; 00 bilingual and monolingual children in this study show poor abilities in phoneme detection, as they only

achieved below 50% accuracy in phoneme detection. The inconsistency might be due to different formats of phonological awareness tests.

Bilingual and monolingual children in this study were judged to show phoneme awareness if they were able to achieve at least 70% accuracy in both phoneme detection and phoneme identification tasks (Rvachew, Ohberg, Grawburg, & Heyding, 2003). Phoneme detection task in this study employed an oddity format, the participant had to select the word that showed a different initial consonant from three choices; (Appendix I, task 5), while onset detection task in Woo's (1993) study used a similarity task format and the participant had to select a phoneme from three choices which was present in the word produced by the examiner. Bilingual and monolingual children in this study showed a lower percentage of accuracy in the phoneme detection task relative to the onset detection task in Woo's (1993) study. The difference in percentage of accuracy in two tasks was attributed to task difficulty. Ho & Bryant (1997a) mentioned that phonological tasks with an oddity format were more difficult than tasks with a similarity format. Therefore, it might be easier for children to get the correct answer in tasks with a similarity format.

Comparison of phonological awareness in Cantonese-English bilinguals and English-speaking monolinguals

Phonological awareness of Cantonese and English required manipulation of syllable, rhyme and phoneme. The developmental sequence of phonological awareness in English in English-speaking monolinguals was similar to the sequence of phonological awareness in Cantonese in Cantonese-English bilinguals; syllable and rhyme awareness in English emerged before phoneme awareness (Jackson et al., 1998). Phoneme awareness in English-speaking monolinguals and Cantonese-English bilinguals was latest developed, but rhyme awareness was acquired in four-year-old children (Burt et al., 1999). The emergence of rhyme awareness in English in English monolingual was earlier than rhyme awareness in

Cantonese in Cantonese-English bilinguals, as the bilinguals in this study achieved about 60% accuracy in rhyme detection. As two Cantonese words rhyme only if they shared the same nucleus, coda and tones, rhyming words were often sacrificed to conserve the meaning of nursery songs, Cantonese-English bilinguals might be less exposed to nursery rhymes. Children in Western communities might be more exposed to rhymes. Rhyme awareness might emerge earlier in English speaking children than in Cantonese-English bilingual children (Carlisle, 1991, cited in Kam (1996)).

Conclusion

The present study investigated the relationship between bilingualism and phonological awareness in children. The results suggested that Cantonese-English bilinguals and Cantonese-speaking monolingual showed similar scores of syllable awareness, rhyme awareness and phoneme awareness. The bilingual participants showed better tone awareness than monolingual peers. In addition, tone and rhyme awareness emerged before rhyme awareness, which emerged before phoneme awareness. The results provided evidence that bilingualism is not self-explanatory for acquisition of phonological awareness. The nature of languages learned by bilinguals, duration of exposure to alphabetical language and the method of learning languages might be important factors in determining level of phonological awareness in bilingual children.

Further research

In the studies of bilingualism and phonological awareness, it was difficult to check if the results were due to second language learning or the influence of bilingualism. In order to determine if bilingualism affects the development of phonological awareness, comparison of phonological awareness of bilinguals with different language pairs should be made. In addition, phonological awareness was closely related to the development of literacy of English (Burt, et al., 1999) and Cantonese (Ho & Bryant, 1997a; Chow, McBride-Chang, & Burgess, 2005). As English and Chinese showed different systems of orthography, further

research on how different types of orthography (transparent, opaque and logographic) influenced the acquisition phonological awareness is recommended.

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References

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

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

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

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

Burt, L., Holm, A., & Dodd, B. (1999). Phonological awareness skills of 4-year-old British children: An assessment and developmental data. *International Journal of Communication Disorders, 34*, 311-355.

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

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

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

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

Chow, B. W. T., McBride-Chang, C., & Burgess, S. (2005). Phonological processing skills and early reading abilities in Hong Kong Chinese kindergarteners learning to read English as a second language. *Journal of Educational Psychology, 97*, 81-97.

de Houwer, A. (1995). Bilingual language acquisition. In EDITORS (Eds.), *The handbook of child language*. Oxford: Blackwell Publishers.

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

Eviatar, Z., & Ibrahim, R. (2000). Bilingual is as bilingual does: Metalinguistic abilities of Arabic-speaking children. *Applied Psycholinguistics, 21*, 451-471.

Gorman, B. K., & Gillian, R. B. (2003). Phonological awareness in Spanish: A tutorial for speech-language pathologists. *Communication Disorders Quarterly, 25*, 13-23.

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

Ho, C. S. H., & Bryant, P. (1997a). Development of phonological awareness of Chinese children in Hong Kong. *Journal of Psycholinguistic Research, 26*, 109-126.

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

Hoffmann, C. (1991). *An introduction to bilingualism*. New York: Longman Group.

Holm, A., & Dodd, B. (1996). The effect of first written language on the acquisition of English literacy. *Cognition, 59*, 119-147.

Jackson, N., Holm, A., & Dodd, B. (1998). Phonological awareness and spelling abilities of Cantonese-English bilingual children. *Asia Pacific Journal of Speech, Language and Hearing, 3*, 79-96.

Kam, A. C. S. (1996). *Syllable, rhyme and phoneme awareness in phonologically impaired preschoolers.* Unpublished B.Sc. (Speech and Hearing Sciences) honours dissertation. The University of Hong Kong.

Ladefoged, P. (2001). *A course in phonetics*. (4th ed.). Fort Worth: Harcourt.

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

McCormick, M. (1995). The relationship between the phonological processes in early speech development and later spelling strategies. In Dodd, B. (Ed.), *Differential Diagnosis and Treatment of Children with Speech Disorder* (pp. 111-124). London: Whurr.

Reynell, J. (1987). *Reynell Developmental Language Scale*, Cantonese version. Windsor: NFER-Nelson.

Rvachew, S., Ohberg, A., Grawburg, M., & Heyding, J. (2003). Phonological awareness and phonemic perception in 4-year-old children with delayed expressive phonology skills. *American Journal of Speech-Language Pathology, 12*, 463-471.

So, L. K. H., & Dodd, B. (1995). The acquisition of phonology by Cantonese-speaking children. *Journal of Child Language, 22*, 473-495.

Tunmer, W. E., & Rohl, M. (1991). Phonological awareness and reading acquisition. In Sawyer, D. J., & Fox, B. J. (Eds.), *Phonological awareness in reading: The evolution of current perspectives* (pp. 1-30). New York: Springer-Verlag.

Wong, G. K. P. (1997). *Phonological awareness of Cantonese-speaking language-disordered children.* Unpublished B.Sc. (Speech and Hearing Sciences) honours dissertation. The University of Hong Kong.

Woo, C. Y. M. (1993). *Phonological awareness in 4-6 year old Cantonese-speaking children.* Unpublished B.Sc. (Speech and Hearing Sciences) honours dissertation. The University of Hong Kong.

Appendix A. Tasks instructions and test items
(Adopted from Kam (1996) and Wong, (1997))

Syllable awareness task

Task 1 Syllable counting

Counting real objects. Four pictures, each picture contains a different number of cars (one to four). The participant is asked to count the number of cars in each picture.

Instructions:

“Here are four pictures, can you tell me how many cars are there in each picture? (Participant responds). Great! Now, listen, I said /syt$_3$ kou$_{55}$/ (ice-cream). How many words are there in /syt$_3$ kou$_{55}$/? Let’s count, there are two words in /syt$_3$ kou$_{55}$/. Now, it is your turn.”

□呢度有四幅圖畫，你數下每幅圖畫有幾多架車車。(Participant responds) □啦，宜家聽住喎。我話□雪糕□，□雪糕□有幾多個字呀？我□地數下，□雪糕□有兩個字呀。宜家到你數啦。□

Counting syllables.

Practice trials

1. 檯	/t^{h}□i$_{35}$/	(Table)
2. 超級市場	/ts^{h}iu$_{55}$ k□p$_5$ si$_{23}$ ts^{h}□ŋ$_{21}$/	(Supermarket)

Test trials

1. 香蕉	/h□ŋ$_{55}$ tsiu$_{55}$/	(Banana)
2. 杯	/pui$_{55}$/	(cup)
3. 士多啤梨	/si$_{22}$ t□$_{55}$ pɛ$_{55}$ lei$_{35}$/	(Strawberry)
4. 朱古力	/tsy$_{55}$ ku$_{55}$ lik$_5$/	(Chocolate)
5. 巴士	/pa$_{55}$ si$_{35}$/	(Bus)
6. 麥當勞	/m□k$_2$ t□n$_{55}$ lou$_{21}$/	(McDonald)

Syllable awareness task

Task 2 syllable detection

Instruction:

“I would like to play a game with you. Listen carefully. What will be left if /jyn$_{21}$/ is taken away from /jyn$_{21}$ p□t$_{5}$/ (pencil)? I think /p□t$_{5}$/ will be left. How about this one? If /p□t$_{5}$/ is taken away from /jyn$_{21}$ p□t$_{5}$/, what will be left? (Participant responds). You are right. Let’s have more trials.”

「我同你玩個遊戲，留心聽啦，你估□鉛筆□拎走□鉛□字剩番咩呢？我諗剩番□筆□。咁□鉛筆□拎走□筆□剩番咩呢？ (Participant responds)　啦，不如我地試多幾次呀。□

Practice trials	Syllable to be deleted		
1. 電話	- 電	/tin$_{22}$ wa$_{35}$/	(telephone)
2. 搖搖板	- 板	/jiu$_{21}$ jiu$_{21}$ pan$_{35}$/	(seesaw)

Test trials	Syllable to be deleted		
1. 油炸鬼	- 油	/j□u$_{21}$ tsa$_{33}$ kw□i$_{35}$/	(fritter)
2. 雪糕	- 糕	/syt$_{3}$ kou$_{35}$/	(ice-cream)
3. 公園	- 公	/kuŋ$_{55}$ jyn$_{35}$/	(park)
4. 漢堡包	- 漢堡	/h□n$_{33}$ pou$_{35}$ pau$_{55}$/	(hamburger)
5. 公仔	- 仔	/kuŋ$_{55}$ ts□i$_{35}$/	(doll)
6. 電視機	- 機	/tin$_{22}$ si$_{22}$ kei$_{55}$/	(television)

Rhyme awareness

Task 3 Rhyme detection

Instruction:

“Now, you have to point to the word which sounds similar to this one (point to target word at top left hand corner).”

「 呢度有四幅圖畫，宜家你指俾我睇邊個字後面□音係同呢個字 (point to target word at the top left hand corner) 後面□音係一樣□。□

Practice trials

Target word	Choice A	Choice B	Choice C
1. 手	口	錶	魚
/s□u_{35}/	/h□u_{35}/	/piu$_{55}$/	/jy_{35}/
(hand)	(mouth)	(watch)	(fish)
2. 檯	櫃	袋	葉
/t^h□i_{35}/	/kw□i_{22}/	/t□i_{35}/	/jip$_2$/
(table)	(drawer)	(bag)	(leaf)

Test trials

Target word	Choice A	Choice B	Choice C
1. 口	杯	狗	雲
/h□u_{35}/	/pui$_{55}$/	/k□u_{35}/	/w□n_{21}/
(mouth)	(fish)	(dog)	(cloud)
2. 書	豬	筆	波
/sy_{55}/	/tsy$_{55}$/	/p□t_5/	/p□$_{55}$/
(book)	(pig)	(pencil)	(ball)
3. 海	檯	魚	手
/h□i_{35}/	/t^h□i_{35}/	/jy_{35}/	/s□u_{35}/

(sea)	(table)	(fish)	(hand)
4. 蛋	狗	碟	鏟
/tan$_{35}$/	/k□u$_{35}$/	/tip$_{35}$/	/ts^{h}an$_{35}$/
(egg)	(dog)	(plate)	(shovel)
5. 沙	車	花	海
/sa$_{55}$/	/ts^{h}ɛ$_{55}$/	/fa$_{55}$/	/h□i$_{35}$/
(sand)	(car)	(flower)	(sea)
6. 筆	粥	骨	橙
/p□t$_{5}$/	/tsuk$_{5}$/	/kw□t$_{5}$/	/tsaŋ$_{35}$/
(pencil)	(congee)	(bone)	(orange)

Tone awareness

Task 4 Tone detection

Instruction:

“Now, we listen to two words, /ma$_{55}$/, /ma$_{33}$/, the tone of /ma$_{55}$/ is higher than that of /ma$_{33}$/, so they are not the same. Now we try another two words, /t□$_{55}$/, /t□$_{55}$/. Are they the same? (Participant responds). Right, they are the same. Let’s try some more trials.”

「 宜家我地聽下兩個字，□ 媽□ /ma$_{55}$/□ 嗎□ /ma$_{33}$/。□ 媽□ 係高音過□ 嗎□ □,所以佢地係唔一樣□，宜家試下另外兩個字， □ 多□ (/t□$_{55}$/)，□ 多□ ，佢地係咪一樣呀？(Participant responds) 啦，佢地係一樣□， 宜家不如試多 D 字啦。□

Practice trials:

1 詩 /si$_{55}$/ (poem) 詩 /si$_{55}$/ (poem)

2	張	/ts□ŋ$_{55}$/	(Cheung,a surname)	獎	/ts□ŋ$_{35}$/	(reward)

Test trials:

1	日	/j□t$_{2}$/	(sun)	日	/j□t$_{2}$/	(sun)
2	耀	/jiu$_{22}$/	(light)	要	/jiu$_{33}$/	(want)
3	開	/h□i$_{55}$/	(open)	害	/h□i$_{22}$/	(harm)
4	妮	/nei$_{21}$/	(girl)	妮	/nei$_{21}$/	(girl)
5	誕	/tan$_{33}$/	(born)	單	/tan$_{55}$/	(odd)
6	畸	/k^{h}ei$_{55}$/	(abnormal)	畸	/k^{h}ei$_{55}$/	(strange)
7	泥	/l□i$_{21}$/	(mud)	泥	/l□i$_{21}$/	(mud)
8	飯	/fan$_{22}$/	(rice)	帆	/fan$_{21}$/	(junk)
9	病	/pɛŋ$_{22}$/	(sick)	餅	/pɛŋ$_{35}$/	(biscuit)
10	水	/s□y$_{35}$/	(water)	碎	/s□y$_{33}$/	(bit)
11	周	/ts□u$_{55}$/	(Chau, A surname)	酒	/ts□u$_{35}$/	(wine)
12	淡	/t^{h}am$_{23}$/	(tasteless)	淡	/t^{h}am$_{23}$/	(tasteless)
13	厚	/h□u$_{23}$/	(thick)	後	/h□u$_{22}$/	(back)
14	褲	/fu$_{33}$/	(trousers)	褲	/fu$_{33}$/	(trousers)
15	檯	/t^{h}□i$_{35}$/	(table)	檯	/t^{h}□i$_{35}$/	(table)
16	唱	/ts^{h}□ŋ$_{33}$/	(sing)	場	/ts^{h}□ŋ$_{21}$/	(ground)
17	使	/si$_{35}$/	(make)	試	/si$_{23}$/	(try)
18	免	/min$_{23}$/	(free)	免	/min$_{23}$/	(free)

Phoneme awareness

Task 5 Phoneme detection

Instructions:

“Some words start with the same sound. For example, /siŋ$_{55}$/ (star) and /sam$_{55}$/ (clothes) have the same initial /s/ sound, but /kuŋ$_{55}$/ (grandfather) does not have an initial /s/ sound, so the initial sound of /kuŋ$_{55}$/ is different from /siŋ$_{55}$/ and /sam$_{55}$/. Now, there are another three words, you have to point to the word (picture) which does not start with the same sound.”

「有 D 字前面□音係一樣□，好似□ 星□ 同□ 衫□ 前面都有個/s/音，但係□ 公□ 前面就冇/s/音啦，所以□ 公□ 前面□音同□ 星□ ，□ 衫□ 前面□音係唔同□。宜家我有另外三個字， 你要指出(圖畫)邊個字前面□音係同其他兩個字係唔同。□

Practice trials

Phoneme			
1. /p/	波	杯	車
	/p□$_{55}$/	/pui$_{55}$/	/tsɛ$_{55}$/
	(ball)	(cup)	(car)
2. /s/	書	貓	衫
	/sy$_{55}$/	/mau$_{55}$/	/sam$_{55}$/
	(book)	(cat)	(clothes)

Test trials

Phoneme			
1. /f/	龜	褲	花

		/kw□i$_{55}$/	/fu$_{33}$/	/fa$_{55}$/
		(tortoise)	(trousers)	(flower)
2	/t/	梳	燈	碟
		/s□$_{55}$/	/t□ŋ$_{55}$/	/tip$_{35}$/
		(comb)	(light)	(plate)
3.	/ts/	豬	遮	包
		/tsy$_{55}$/	/tsɛ$_{55}$/	/pau$_{55}$/
		(pig)	(umbrella)	(bread)
4.	/p^{h}/	盆	床	婆
		/pun$_{21}$/	/ts^{h}□ŋ$_{21}$/	/p□$_{21}$/
		(basin)	(bed)	(grandma)
5.	/kw/	骨	龜	書
		/kw□t$_{5}$/	/kw□i$_{55}$/	/sy$_{55}$/
		(bone)	(tortoise)	(book)
6.	/j/	耳	馬	葉
		/ji$_{23}$/	/ma$_{23}$/	/jip$_{2}$/
		(ear)	(horse)	(leaf)

Phoneme awareness

Task 6 Phoneme identification

Instruction:

“Look at the picture, these animals make different sounds. The cow makes sound like this: /m/; the dinosaur makes sound like this: /h/; and the snake makes sound like this: /s/. The sounds at the beginning of some words are the same as the sounds made by these animals. For example, the sound at the beginning of /mun$_{21}$/ (door) is the same as the sound made by the cow. Now, see if you can match the sounds at the beginning of these words with the sounds made by these animals. ”

「 睇下幅圖畫，呢三隻動物 D 叫聲都唔同□。牛仔□叫聲係/m/；恐龍□叫聲係 /h/ 咁□；蛇仔□叫聲係 /s/ 咁□。有 D 字前面□音同呢三隻動物□叫聲係一樣□喎。好似□門□ 前面□音就同牛仔□叫聲 /m/ 一樣啦。宜家睇下你可唔可以指出跟住 D 字前面□音係同邊隻動物□叫聲係一樣□。□

Practice items:

1. 媽	/ma$_{55}$/	(mother)
2. 衫	/sam$_{55}$/	(clothes)
3. 紅	/huŋ$_{21}$/	(red)

Test items:

1. 水	/s□y$_{35}$/	(water)
2. 海	/h□i$_{35}$/	(sea)
3. 面	/min$_{22}$/	(face)
4. 喊	/ham$_{33}$/	(cry)
5. 馬	/ma$_{23}$/	(horse)
6. 手	/s□u$_{35}$/	(hand)

Phoneme awareness

Task 7 Phoneme production

Instruction:

"Now, we say some interesting sounds. Let's say /h/, I can make a word starts with this sound, "h --- /ha_{55}/" (shrimp). Now, see if you can try other sounds and make more words for me."

「 我□地宜家講一 D 好得意□音。我□地一齊講 /h/。我可以用呢個音做 D 字出 □黎，好似□ h --- /ha_{55}/ (蝦)□ 咁。不如宜家你試下講其他 D 音再做多 D 字出□黎啦。□

Practice trials:

Target phoneme	Example of words
1 /w-/	雲，黃
2 /p^h-/	爬，被

Test trials:

Target phoneme	Example of words
1 /s-/	沙，手
2 /ts^h-/	茶，車
3 /l-/	啦，泥
4 /f-/	褲，花
5 /m-/	媽，襪
6 /k^h-/	曲，球

Appendix B

Table A1

Types of errors in phoneme production task

Types of errors	Descriptions	Examples

English errors	An English word was produced for the target Cantonese phoneme	“fish” was produced for target Cantonese phoneme /f-/
Phonologically related errors	Produced word showed the same place or manner of articulation as the target phoneme	□ 媽 □ (“mother”) /ma_{55}/ was produced for target /f-/
Unrelated errors	Produced word did not show the same place or manner of articulation as the target phoneme	□ 八□ “eight” /pat_{3}/ was produced for target phoneme /p^{h}-/
Others errors	Non-speech sound was produced	the sound of wind was produced for phoneme /f-/
No response	No word was produced	N/A