Title	Bilingual (Cantonese and Putonghua) phonological development: Dominance Perspective
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Citation	
Issued Date	2004
URL	http://hdl.handle.net/10722/48783
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Bilingual (Cantonese and Putonghua) Phonological Development: Dominance Perspective

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A dissertation submitted in partial fulfillment of the requirements for the Bachelor of Science (Speech and Hearing Sciences), The University of Hong Kong, May 7. 2004.

Abstract

The study investigated the similarities and differences in Cantonese and Putonghua phonological development in bilinguals with different language dominance. One hundred bilingual children aged from 2;6- 4;11 were recruited in Hong Kong and Shenzhen. Cantonese Segmental Phonology Test (So, 1993) and Putonghua Segmental Phonology Test (So & Zhou, 2000) were used to elicit phonemes of both languages. The percentage phoneme correct, age of phoneme emergency and phonological processes were the measurements of phonological development. The result indicated that language dominance played a role in Cantonese and Putonghua phonological development. The rate of Cantonese, and Putonghua phonological development was faster in children with respective dominant language background than those with non-dominant language background. However, the phonological development of dominant language might not be faster than that of non-dominant language in a bilingual. Discussion on the theories, and the extent of influence of language background on bilingual phonological acquisitions was made.

Introduction

Monolingual phonological acquisition has been focused for past decades. The normal acquisition patterns and theories of monolingual phonological acquisition were suggested for different languages (Li & Thompson, 1976; So & Dodd, 1995; Zhu & Dodd, 2000). However, it was estimated that nearly half of the total preschoolers in the world were bilinguals who were acquiring two languages (Grosjean, 1982). Duncan (1989) indicated that the bilingual has an integrated linguistic system rather than being the sum of two monolinguals. Research studying different language combinations in bilinguals revealed that there were quantitative and qualitative differences between bilingual and monolingual language acquisition (De Houwer, 1995; Romaine, 2001). Bilinguals could be broadly classified into either simultaneous or successive bilinguals by the onset of exposure of the two languages. Simultaneous bilinguals acquire the two languages at the same time while successive bilinguals acquire the second language after the fist language has developed (Crystal, 2003). Dodd, So and Li (1996) revealed that Cantonese-English successive bilingual children showed different patterns of phonological development when compared to the monolinguals, as their error patterns were unique to each language. The longitudinal study of successive Cantonese-English bilinguals further supported the notion that successive bilinguals developed differently when compared to monolinguals as they exhibited a number of error patterns that did not present in monolinguals (Holm & Dodd, 1999). The patterns of phonological development in simultaneous bilinguals were also documented. Goldstein & Washington (2001) investigated twelve four-year-old typically developed Spanish- English simultaneous bilinguals and found that the bilinguals exhibited different patterns of developments when compared with monolinguals. Similar results were found in the cross-sectional and longitudinal studies of early phonological acquisition in simultaneous Japanese-English and Norwegian-English bilinguals (Johnson & Lancaster, 1998; Mori, 2002). In conclusion, the studies suggested that bilinguals exhibit different patterns in the

path of phonological acquisition when compared with monolinguals. The cross- populational differences in the order of phoneme acquisitions between monolinguals and bilinguals could not be fully accounted by the theories concerning universality of language acquisition such as "law of irreversible solidarity" proposed by Jakobson (1941/ 1986) which suggested that the phonological acquisition is governed by the phonological complexity of the phonemes so that the order of phonemes emergency and the sequence of development in a language would be totally determinable. Research studying bilinguals' phonological acquisition suggested that language inputs and the extent of use of the languages influence the phonological developments in a certain extent (Bialystok, 2001; Zhu, 2002). However, the extent of the influence of language inputs and use has not been explored.

Bilinguals tended to be dominant in one of their languages due to factors such as exposure, experiences and use (Yavas, 1998). Baker (1992) described the state of bilingualism as a dynamic situation in which the balance of the languages of a bilingual depends on the pattern of language use. The language that the person uses more frequently is defined as dominant language while the one use less is defined as non-dominant language. Watson (1991) and Romaine (2001) supported the notion that the bilingual children are dominant in one of the languages, and the acquisition of the dominant language influences the acquisition of the non-dominant language. Influence could be qualitative in which dominant language developed faster than non-dominant one, and could be qualitative in which phonological interference occurred. It was generally agreed that interference occurred only when the bilinguals developed and used the languages separately (Romaine, 1995; Yavas, 1998). Linguistic contrasts or differences between the two systems may lead to interference which affect the acquisition process after differentiation of languages (Watson, 1991). A bilingual child may fail to realize that a feature in one language is not shared by the others so cross-linguistic assimilation and realization occurred. Yavas (1998) suggested four types of interference patterns in successive bilinguals including under-differentiation of phonemes,

over-differentiation of phonemes, reinterpretation of distinctions and phone substitution. The study carried out by Fantini (1985) reported that a simultaneous Spanish dominant Spanish-English bilingual child acquired Spanish phonology faster than English phonology. The research also indicated that the dominant phonology interfered some of the phonemes production of the non-dominant language as some of the English vowels and diphthongs being assimilated to Spanish vowels, and English consonants being substituted by Spanish consonants. Subsequent research indicated that there were differences in rate, and patterns of substitution in the acquisition of rhotic consonants and lateral fricative between Welsh dominant and English dominant Welsh-English simultaneous bilinguals (Ball, Muller & Munro, 2001a & b). Although increasing research supported that dominance played a role in phonological acquisition in simultaneous bilinguals by studying Indo-European languages such as English, Spanish and Welsh, the effect of language dominance in Sino-Tibetan languages has not been explored.

The languages investigated in this research were Cantonese and Putonghua. Brief overviews of these two phonological systems were provided below.

Cantonese Phonology: Cantonese, also called as Yue dialect, is a Chinese dialect spoken by around 40 million people mainly in Guangdong and Hong Kong (Bauer and Benedict, 1997). The phonotactic structure is simple which consists of (C)V(C). Almost all syllables (98%) are in consonant-vowel (CV) or consonant-vowel-consonant (CVC) structures. Cantonese has six contrastive tones which are obligatory in the syllable, and three entering tones which are the allotones of the three level tones. There are eleven vowels [i, ɪ, y, ɛ, œ, ɵ, ɐ, a, ʊ, ɔ, u], eleven diphthongs [iu, au, ɐu, ou, ɔi, ui, ai, ɐi, ei, ɵy, ɛu], nineteen initial consonants [p, p^h, t, t^h, k, k^h, k^w, k^{wh}, m, n, ŋ ,f, s, h, ts, ts^h, l, j, w] and six final consonants [p, t, k, m, n, ŋ]. There are free variants in present Cantonese which are summarized as initial /n/ → [l] (e.g. /nai_{23}/ → [lai_{23}] 奶 “milk”), deletion of initial /ŋ/ (/ŋa_{21}/ →[a_{21}] 牙 “teeth”), initial / k^w/ → [k] when

preceding the vowel /ɔ/ (e.g. /$k^{w}ɔ_{25}$ / → [$kɔ_{25}$] 果 “fruit”), initial / k^{wh} / → [k^{h}] (e.g. /k^{wh} $ɐn_{21}$ / → [$k^{h}ɐn_{21}$] 裙 “dress”), and final /ŋ/ → final [n] (e.g./$ts^{h}aŋ_{25}$/ → [$ts^{h}an_{25}$] in “orange”) (Bauer & Benedict, 1997). The above free variants were not considered as error productions in this study.

Putonghua Phonology: Putonghua is a Sino-Tibetan language which is the official language in present China. Surveys indicated that 90% of the people in China understand Putonghua, and about 50% of them can speak it. (Wu & Yin, 1984) The phonotactic structure is the same as Cantonese (C)V(C). Putonghua is a tonal language which change in tone of the syllable can lead to changes in meaning such as /si_{55}/ “silk” and /si_{214}/ “dead’. There are four tones in Putonghua, including high level, high rising, falling-rising and high falling. Tone sandhi is the normal alternations of tones in Putonghua and closely associates with the morphological structures of Chinese words and grammatical structures (Zhu, 2002). There are twenty-one initial consonants [p, p^{h}, t, t^{h}, k, k^{h}, m, n, f, s, ɕ, x, ʂ, ts, ts^{h}, tɕ, $tɕ^{h}$, tʂ, $tʂ^{h}$, l, ʐ] and two final consonants [n, ŋ]. Among the twenty-two consonants in Putonghua, twenty-one could be the initial consonants with the exception of /ŋ/ which could only be final consonant. The vowel system of Putonghua is more complex than Cantonese. There are nine monothongs [i, u, y, o, ɤ, ʌ, ə, ɛ, ɚ], eleven diphthongs [ae, ei, ao, oʊ, iʌ, iɛ, uʌ, uo, yɛ] and four triphthongs [iɑo, ioʊ, uae, uei].

In summary, the phonological systems of Cantonese and Putonghua are similar. They are both tonal languages with the same syllabic structure. Among the nineteen syllable initial consonants in Cantonese and twenty-one syllable initial consonants in Putonghua, thirteen of them are the same. Putonghua phonology is generally more complex than Cantonese as it contains triphthongs, and consonants in retroflex and alveolo-palatal places. Comparisons between Cantonese and Putonghua phonology were summarized in Appendix 1.

The aim of the research is to describe the developmental patterns of phonological

acquisition of typically developing simultaneous bilinguals of Sino-Tibetan languages (Cantonese and Putonghua) with different language dominance.

If language dominance affects phonological development, there would be quantitative and qualitative differences in Cantonese, and Putonghua development in bilinguals with different language dominance. For Cantonese development, it was hypothesized that the Cantonese dominant bilinguals developed faster than the Putonghua dominant bilinguals because Cantonese dominant bilinguals used and exposed to Cantonese more frequently. Similarly, Putonghua dominant bilinguals were hypothesized to have a faster Putonghua development than Cantonese dominant bilinguals.

Language dominance was hypothesized to affect the phonological development in the bilinguals also. In Cantonese dominant bilinguals, it was hypothesized that the Cantonese phonological development would precede the Putonghua phonological development. Likewise, the Putonghua phonological development was predicted to be faster than the Cantonese phonological development in Putonghua dominant bilinguals.

Moreover, phonological interference in which dominant phonology interfered some of the phonemes production in non-dominant phonology would be observed.

Method

Research Design: Cross-sectional research design was adopted in this study. The assumption underlying cross-sectional research design was that sufficient number of participants would minimize individual differences in language developments. The purpose was to obtain a representative picture of children's development over a certain period of time and establish norms for the rate and patterns of development for children at a particular age.

Participants: A hundred children aged 2;06 to 4;11 were recruited from nursery schools and kindergartens in Hong Kong and Shenzhen. Parent reports ensured that all children acquired the two languages simultaneously and used them regularly in daily life. A questionnaire, which was modified from Language Background Scale (Baker, 1992), was used to document

the language dominance by measuring the amount of use of the two languages in daily lives (See appendix 2). The questionnaire was distributed by the nursery schools and kindergartens to parents, and returned before the assessment session. The children were divided categorically as either "Cantonese dominant" or "Putonghua dominant" by the scale. Balanced bilinguals were excluded in this study. Children's intellectual abilities, hearing status and oromotor functions were within normal limits from the parents' and teachers' reports. The Cantonese language level of all participants was within one standard deviation when assessed by Reynell Developmental Language Scale (Cantonese version) (Reynell & Hurtley, 1987). The mean length of utterance (MLU) of their spontaneous productions in Putonghua were within age appropriate level when compared with Brown Scale (Brown, 1973). A balanced distribution was achieved between boys and girls within each age group. In conclusion, the age, onset of exposure, language background, intellectual abilities, hearing status, oromotor functions, language status and sex were considered in participants' selection. The subject information in the study was listed in Table 1.

Table 1. Subject information in each age group

Age group	Cantonese dominant		Putonghua dominant	
	Male	Female	Male	Female
2;06- 2;11	5	5	5	5
3;00- 3;05	5	5	5	5
3;06- 3;11	5	5	5	5
4;00- 4;05	5	5	5	5
4;06- 4;11	5	5	5	5
Total	25	25	25	25

Test Materials: Cantonese Segmental Phonology Test (So, 1993) and Putonghua Segmental Phonology Test (So & Zhou, 2000) were used. Both phonological tests include a picture-naming test and sample all tones, vowels, and initial and final consonants in

Cantonese and Putonghua respectively. The chosen words were names of common objects that a two-year-old child could produce spontaneously. High quality photographs of real objects were used to elicited production. Story retelling task was also included in both tests in order to sample continuous speech in two languages.

Procedure: The children were assessed in a quiet room individually at their nursery schools or kindergartens. The standard procedures listed in the phonological tests were administered. The examiner offered semantic and contextual prompts if the child failed to produce the target word in the picture-naming tasks. The participants were requested to imitate the examiner's production if they did not respond to above probing strategies. Elicitation by imitation was not considered to be an issue of concern given that a number of authors had not found a difference in performances and error patterns between imitated and spontaneous responses (Ball, Muller & Munro, 2001a & b; Sigel, Winitx & Conkey, 1963). The two most frequent imitated Cantonese words were /$ts^{h}ɔŋ_{21}$/ ("bed", 17%) and /$kœk_{3}$ pan_{25}/ ("foot", 16.7%). The two most frequent imitated Putonghua words were /$ʐən_{55}$/ ("people", 21%) and /$tsuei_{214}$/ ("mouth", 15%). The speech productions of the participants were recorded on Sony recordable minidisks using Sharp portable minidisk recorder MD-MT770 and an Aiwa stereo condenser microphone CM-TS22 which was clipped on the shirts of the participant at chest level. The productions of the participants were transcribed by using IPA symbols. Intra-rater reliability and inter-rater reliabilities were computed in point-by-point basis. A native Cantonese speaker and a native Putonghua speaker were invited to transcribe ten percent of the data. The intra-rater reliabilities were above 99.7% while the inter-rater reliabilities were above 98.3% for Cantonese data. The intra-rater reliabilities were above 98.2% while the inter-rater reliabilities were above 97.5% for Putonghua data. The discrepancies between the two transcribers were resolved by face-to face discussion after listening to the speech productions together.

Data Analysis: Independent analysis which described the children's speech independently, and relational analysis which compared their production with the adult target form were used to measure the phonological developments of the participants.

1. Percentage Phoneme Correct (PPC): PPC for each child reflected accuracy of consonants, and vowels articulated correctly in the sample. It was calculated by the formula (Number of correct phonemes / Total number of phonemes in the sample X 100%).
2. Age of Emergency of phoneme: Each phoneme was considered to be emerged when 90% of the children in an age group produced the phoneme correctly in correct positions at least two times.
3. Phonological Process: The consistent differences between children's realizations and adult's target forms are described as phonological processes. The processed that were used by more than ten percent of the children in an age group were selected for further analysis.

Results

i. Percentage Phoneme Correct (PPC)

A four-way ANOVA, Age (5) X Sex (2) X Dominance (2) X Test (2), was computed with the percentage phoneme correct (PPC) as dependent variables. Age (five age groups), sex (male vs female), dominance (Cantonese vs Putonghua) were between participant factors, while test (CSPT vs PSPT) was within-participant factor. The main effect of age was highly statistically significant [$F(4,80) = 637.98$, $p < 0.01$], indicating the percentage phoneme correct increases with age. The main effect of test was also significant [$F(1,80) = 305.44$, $p < 0.01$], indicating the percentage phoneme correct of CSPT was higher than that of PSPT. The results suggested that Cantonese developed faster than Puthonghua. The interaction between age and test reached statistical significance [$F(4,40) = 31.200$, $p < 0.01$]. Post hoc comparisons by Turkey test revealed that the PPC of CSPT was higher than the PPC of PSPT in all the four younger age groups. This suggested that the Cantonese developed faster than

Putonghua in general. The p level increased with age suggesting that the between group difference between CSPT and PSPT decreased when age increased. More importantly, the interaction effect between dominance and test was statistically significant [F (1,80) = 39.176, p<0.01]. Post hoc comparisons by Turkey test revealed that the effect of dominance in Cantonese and Putonghua development were statistically significant [p <0.01]. Cantonese dominant participants had a higher Cantonese PPC than Putonghua dominant participants. Likewise, Putonghua dominant participants had a higher Putonghua PPC than Cantonese dominant participants. The interaction between age and dominance was significant [F (4,80) = 2.6459, p <0.05]. Post hoc comparisons by conducting Turkey test were conducted to examine the significant interaction effect. The result revealed that the differences in percentage phoneme correct between Cantonese dominance participants and Putonghua dominance participants in each age group were not statistically significant.

The findings by statistical analysis of percentage phoneme correct were summarized as follow. Cantonese and Putonghua developed with increased age. The main effect of test revealed that the general development in Cantonese was faster than Putonghua. Language dominance played a role in Cantonese phonological development as Cantonese dominant participants developed faster than Putonghua dominant participants. Dominance effect also exists in Putonghua phonological development as Putonghua dominant participants developed faster than Cantonese dominant participants. However, the rate of phonological developments between the dominant and non-dominant language in the bilinguals did not reach statistical significance. In Cantonese dominant participants, the Cantonese development was faster than the Putonghua development. However, the Cantonese development also was faster than Putonghua development in Putonghua dominant participants.

ii. Cantonese Development

Tone: Tonal errors were rare in the youngest group of both Cantonese dominant and Putonghua dominant bilinguals. The Cantonese dominant bilinguals did not produce tonal

errors. Two errors were made in the youngest group of Putonghua dominant bilinguals. The errors were the confusion between high rise $_{(25)}$ and low rise $_{(23)}$. A child produced /nɐu$_{25}$/ → [lɐu$_{23}$] in”鈕”(button) and the other child produced / ŋan$_{23}$/ → [ŋan$_{25}$] in ‘眼” (eye).

Vowel: All vowels and diphthongs emerged in the youngest groups of Cantonese dominant and Putonghua dominant group. Diphthong reduction occurred occasionally. Two of them produced /pui$_{55}$/ → [pu$_{55}$] in “杯”(cup), and one child produced /kɐi$_{55}$/ → [kɐ$_{55}$] in “ 雞”(chicken)

Consonant: Table 4 showed the phoneme emergency in the five age groups in Cantonese, and Putonghua dominant bilinguals. The phoneme acquisition by monolinguals (So & Dodd, 1995) was also listed for comparison. As sex was not a statistical significant factor in the present study, information for the different sexes was not presented separately.

Table 2. Age of emergency of syllable-initial and syllable- final consonants in Cantonese

(Criterion: 90% of subjects)

Age group	Cantonese monolingual (So & Dodd, 1995)	Cantonese Dominant Bilingual	Putonghua Dominant Bilingual
2;06-2;11	n, p, t, j ,m, w, ŋ, -p, -k	p, t, k, m, ŋ, j, w, -m	p, t, k, m, n, ŋ, w, j
3;00-3;05	h, k , -n, -m, -ŋ	h, l, -p, -t, -k, -n, -ŋ	h, l, -m, -n, -ŋ
3;06-3;11	l, $p^{h,}$, t^{h}, k^{h}, -t	p^{h}, t^{h}, f,	p^{h}, t^{h}, -p, -t
4;00-4;05	f,s, ts	k^{h}, s	k^{h}, f, s, -k
4;06-4;11	ts^{h}, k^{w}, k^{wh} ‡	ts, ts^{h}	ts
>4;11		k^{w}, k^{wh} ,n	ts^{h}, k^{w}, k^{wh}

‡ / ts^{h}/, /k^{w}/, /k^{wh}/ had not emerged at 4;06 in the study of So & Dodd (1995)

Gradual emergency of phonemes across age groups were observed in Cantonese dominant bilinguals and Putonghua dominant bilinguals. The initial consonants emerged before final consonants. Plosives, nasals, and lateral approximants emerged earlier than

fricatives in Cantonese dominant and Putunghua dominant group. The last emerged manner was affricate in which both dominant groups emerged after 4;06. Unaspirated plosives were emerged earlier than the aspirated ones. / k^w/ and /k^{wh}/ were the phonemes emerged last in the two groups. Fourteen consonants (56%) were emerged in the same age group in the two dominant groups including initial consonants / p, t, k, m, ŋ, j, w, h, l, p^h, t^h ,k^h, s, ts/ and final consonants /n, ŋ/. Among the differences, all phonemes, except the initial consonant /n/, emerged earlier in the Cantonese dominant group. It was because most of the Cantonese dominant bilinguals produced the normal realization of /n/ (e.g. /nai_{23}/ → [lai_{23}] in 奶 "milk"). The phonological processes of initial consonants were listed in Table 3. The types of phonological process used by Cantonese dominant and Putonghua dominant bilinguals were the same as that of monolinguals. The bilinguals used de-labialisation (e.g. /k^wa_{55}/ → [ka_{55}] in "瓜"(melon)), fronting (e.g. /kϵi_{55}/ → [tϵi_{55}] in "雞"(chicken)), de-aspiration (e.g. /$k^h\epsilon m_{21}$/ → [kϵm_{21}] in "琴" (piano)), and deaffrication (e.g. /$tsiu_{55}$/ → [siu_{55}] in "蕉"(banana)) in a longer period than the monolinguals. The phonological processes of Cantonese dominant and Putonghua dominant participants were similar. The only difference observed was that the processes de-labialization and fronting existed for a longer period for the Putonghua dominant bilinguals than for the Cantonese dominant bilingual. In Putonghua dominant bilinguals, de-labialization remained as phonological process at 4;06, and fronting remained as processes at 4;00 but the Cantonese dominant bilinguals did not. The examples of the error patterns of the bilinguals were listed in appendix 3.

Table 3. Cantonese phonological processes affecting consonants used by more than 10% of Cantonese monolinguals, Cantonese dominant bilinguals and Putonghua dominant bilinguals

Age Group	2;06-2;11			3;00-3;05			3;06-3;11			4;00-4;05			4;06-4;11		
Participants	PDB*	CDB[ψ]	CM[ϕ]	PDB	CDB	CM	PDB	CDB	CM	PDB	CDB	CM	PDB	CDB	CM
1.De-labialization	*	*	*	*	*	*	*	*	*	*	*		*		
2.Fronting	*	*	*	*	*	*	*	*		*					
3.Stopping	*	*	*	*	*	*	*	*	*						
4.De-aspiration	*	*	*	*	*	*	*	*							
5.Deaffrication	*	*	*	*	*										
6.Affrication	*	*	*												
7.Assimilation	*	*	*												
8.Final C Deletion	*	*	*												
Total Number	8	8	8	5	5	4	4	4	2	2	1	0	1	0	0

* PDB is Putonghua dominant bilingual; [ψ] CDB is Cantonese dominant bilingual,

[ϕ] CM is Cantonese monolingual which is quoted from So & Dodd (1995)

iii. Putonghua Development

Tone: Tonal errors were rare even in the youngest group of both Cantonese dominant and Putonghua dominant bilinguals. The Putonghua dominant bilinguals did not produce tonal errors. Nine errors were made in youngest group of Cantonese dominant bilinguals. The errors were confusion between high rising$_{(35)}$ and falling rising$_{(214)}$ tones. Two children produced /kou$_{214}$/ → [kou$_{35}$] in "狗"(dog), two children produced /tsuei$_{214}$/ → [tsuei$_{35}$] in "嘴"(mouth), two children produced /ɕyŋ$_{35}$/ →[ɕyŋ$_{214}$] in "熊" (bear) and three children produced /luən$_{35}$/ → [luən$_{214}$] in "輪" (wheel).

Vowel: Vowels emerged very early in the development. Children in the youngest group were able to produce all simple vowels and diphthongs in Cantonese dominant and Putonghua dominant bilinguals. All triphthongs emerged in the youngest group in Putonghua dominant bilinguals. The triphthongs /iɑo, iou/ were emerged in the youngest group and /uae, uei/ were emerged later in the age group of 3;00–3;05 in Cantonese dominant bilinguals.

Consonant: The age of consonant emergency was listed in Table 6. The study carried out by Zhu & Dodd (2000) which studied Putonghua phonological development of 1;06- 4;06 was quoted for comparison. Consonants emerged gradually in Cantonese dominant and Putonghua dominant group. Final consonants emerged in the youngest age group the same as the monolinguals. Plosives and nasals emerged earlier than fricatives, lateral approximants and affricates. Twelve consonants (52%) of consonants were emerged in the same age group in the two dominant groups including initial consonants /p, t, k, m, n, x, ɕ, s, ts, ts^{h}/ and final consonants /n, ŋ/. Among the differences, most of the phonemes emerged earlier in the Putonghua dominant group. The phonemes included / p^{h}, t^{h}, k^{h}, f, tɕ, tɕ^{h}, ʂ, ʐ, tʂ/. The only exception was initial consonant /l/ which was emerged earlier in Cantonese dominant group. The phonological processes of consonants were listed in Table 5. The phonological processes used by bilinguals were the same as those of monolinguals. The bilinguals used assimilation

(e.g. /tan$_{51}$ kaʊ$_{55}$/ → [tan$_{51}$ tao$_{55}$] in “蛋糕” (cake)), affrication (e.g. /san$_{214}$/ → [tsan$_{214}$] in “傘“ (umbrella)), aspiration (e.g. /pei$_{55}$/ → [p^{h}ei$_{55}$] in “杯 “ (cup)) and gliding (e.g. /ʐən$_{35}$/ → [jən$_{35}$] in “ 人” (people)) in a longer period than the monolinguals. Other than the differences between monolinguals and bilinguals, there were differences between Cantonese dominant bilinguals and Putonghua dominant bilinguals in the use of phonological process. Cantonese dominant bilinguals used several processes for a longer period than Putonghua dominant bilinguals. Assimilation remained as phonological process in the age group of 3;06 – 3;11, affrication and gliding remained in the age group of 4;00-4;05, initial consonant deletion and X-velarization remained as phonological processes at 4;06-4;11 in Cantonese dominant bilinguals only. The examples of the error patterns of the bilinguals were listed in appendix 3.

Table 4. Age of emergency of syllable-initial and syllable- final consonants in Putonghua (Criterion: 90% of subjects)

Age group	Putonghua monolingual [Ψ] (Zhu & Dodd, 2000)	Cantonese Dominant Bilingual	Putonghua Dominant Bilingual
2;06-2;11	p, t, t^{h}, m, n, f, ɕ, x, -n, -ŋ	p, t, k, m, n, -n, -ŋ	p, p^{h}, t, t^{h}, k, m, n, -n, -ŋ
3;00-3;05	k, k^{h}	t^{h}, x, ɕ ,l	k^{h}, f, x, ɕ
3;06-3;11	p^{h}	p^{h}, k^{h} , f, s	s, tɕ, tɕ^{h}, l
4;00-4;05	s, tɕ, tɕ^{h} ,l, ʐ	ts	ʂ, ts
4;06-4;11	ʂ, ts, ts^{h}, tʂ, tʂ^{h} [Φ]	ts^{h}	ʐ, tʂ, ts^{h}
>4;11		ʂ ,tɕ, tɕ^{h}, tʂ, tʂ^{h}, ʐ	tʂ^{h}

[Ψ] The age of stabilization of consonants was listed due to the discrepancies in definition.

[Φ] /ʂ/, /tʂ/, /ts^{h}/, /ts/, /ts^{h}/ were not emerged after 4;06 in the study of Zhu & Dodd (2000).

Table 5. Putonghua phonological processes used by more than 10% of Cantonese monolinguals, Cantonese dominant bilinguals and Putonghua dominant bilinguals in different age groups.

Age Group	2;06-2;11			3;00-3;05			3;06-3;11			4;00-4;05			4;06-4;11		
Participants	CDB*	PDB**	PM***	CDB	PDB	PM	CDB	PDB	PM	CDB	PDB	PM	CDB	PDB	PM
1.Final C deletion	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
2.Triphthong reduction	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
3.Diphthong reduction	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
4.Backing	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
5.Fronting	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
6.Stopping	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
7.Deaspiration	*	*	*	*	*	*	*	*	*	*	*	*	*	*	

Table 5. (Continue)

Age Group	2;06-2;11			3;00-3;05			3;06-3;11			4;00-4;05			4;06-4;11		
Participants	CDB*	PDB**	PM***	CDB	PDB	PM	CDB	PDB	PM	CDB	PDB	PM	CDB	PDB	PM
8.Aspiration	*	*	*	*	*	*	*	*	*	*	*		*	*	
9.IC deletion	*	*	*	*	*	*	*	*	*	*	*	*	*		
10.X-velarization	*	*	*	*	*	*	*	*	*	*	*	*	*		
11.Affrication	*	*	*	*	*	*	*	*		*			*		
12.Gliding	*	*	*	*	*	*	*	*	*	*					
13.Assimilation	*	*	*	*	*	*	*								
Total	13	13	13	13	13	13	13	12	11	12	10	10	11	8	-

* CDB is Cantonese dominant bilingual

** PDB is Putonghua dominant bilingual

*** PM is Cantonese monolingual which is quoted from Zhu & Dodd (2000)

Discussion

The aim of the study was to investigate the Cantonese and Putonghua phonological developments in Cantonese-Putonghua bilinguals with different language dominance. There were several similarities in the phonological developments between Cantonese dominant and Putonghua dominant bilinguals. It was observed that the phonemes emerged gradually across age group. The order of emergency of syllabic structures between the two languages was the same. Tones and vowels were acquired before consonants in Cantonese and Putonghua development by both Cantonese dominant and Putonghua dominant bilinguals. In consonant development, plosives and nasals emerged earlier than fricatives, lateral approximants and affricates in both languages regardless of the language dominance. The above similarities were also documented in monolingual Cantonese and Putonghua phonological acquisition (So & Dodd, 1995; Zhu & Dodd, 2000). The similarities highlighted in these cross-linguistic and cross-populational studies of phonological acquisition revealed there might be universal tendencies in children's phonological acquisition. Jakobson (1941/1968) suggested that acquisition of phonological contrasts was governed by the phonological complexity of the phonemes and the distribution of sound among the word's language. He suggested that the sounds that were more basic and central to all human languages would be acquired earlier than other sounds. According to his "law of irreversible solidarity", there would be a universally applicable sequence of development, and the order of all phonemes emergency could be determinable. Moreover, some of the error patterns in the two dominant groups, and monolinguals were similar. In Cantonese tonal acquisition, the errors were the confusion between high rise $_{(25)}$ and low rise $_{(23)}$ which were consistent with the research conducted in monolinguals (Li & Thompson, 1978). In Putonghua tonal acquisition, the errors occurred were the confusion between high rise $_{(35)}$ and falling rising $_{(214)}$ which were the most evident tonal errors in typically developing monolinguals (Li & Thompson, 1976). The phonological processes used in Cantonese dominant and Putonghua dominant bilinguals were similar to

that of monolinguals. The processes could be classified into either assimilation or systematic simplification errors. This indicated that bilingual simplified the phonological systems in a similar way as monolingual when they tried to learn. The similarities in the phonological acquisition between dominant and non-dominant bilinguals, and monolinguals revealed that bilinguals passed through similar developmental sequence in some aspects as monolinguals.

Despite the similarities between the dominant group and non-dominant groups, there were cross-population differences in rate of phoneme acquisition, age of phoneme emergency and phonological processes in Cantonese and Putonghua. In Cantonese phoneme acquisition, Cantonese dominant bilinguals had higher percentage phoneme correct in all age groups when compared with Putonghua dominant bilinguals. Similarly, Putonghua dominant bilinguals had higher percentage phoneme correct across all age groups in Putonghua developments. The results indicated that the influence of language dominance on the rate of phoneme acquisition in both Cantonese and Putonghua reached statistical significance. Secondly, the order of consonants emergency was different. In general, some of the phonemes emerged earlier in the bilinguals with dominant language background. Six Cantonese consonants emerged earlier in Cantonese dominant bilinguals including initial consonants /f/ and/ ts^h/ and final consonants /m, p, t/ and /k/ when compared with Putonghua dominant bilinguals. Nine Putonghua initial consonants emerged earlier in Putonghua dominant bilinguals including / p^h, t^h, k^h, f, tɕ, tɕ^h, ʂ, ʐ, tʂ/ when compared with Cantonese dominant bilinguals. The differences in consonants emergency in the bilinguals with different language dominances were consistent with the findings of Welsh-English bilinguals. The Welsh rhotic consonants and lateral fricatives were acquired earlier in Welsh dominant bilinguals, while the English rhotic and lateral consonants were acquired earlier in English dominant bilinguals (Ball, Muller & Munro, 2001a & b). Thirdly, the phonological processes used between the bilinguals with different language dominance were different. The Cantonese

dominant bilingual used less phonological processes in the age groups 4;00-4;11 in Cantonese development. The differences in phonological processes in Putonghua development occurred earlier. Assimilation remained as phonological process in the age group of 3;06 – 3;11, affrication and gliding remained as processes in the age group of 4;00-4;05, initial consonant deletion and x-velarization remained as process until 4;11 in Cantonese dominant bilinguals but not in Putonghua dominant bilinguals. The cross-populational differences in the order of phoneme acquisition could not be fully explained by the law of irreversible solidarity (Jakoson, 1968) and other theories concerning the topological universals in phonological acquisition. The language background, that was the exposure and use of language, influenced the rate and order of phoneme acquisition. This provided support of functional theories of phonological acquisition that suggested that language is constructed from the input obtained though the social environment (Bialystok, 2001). Although there might be biological and cognitive universals that guide the process of language acquisition, the emergency of phonemes was governed by the linguistic input.

Phonological interference was rarely observed in the Cantonese-Putonghua bilinguals which was different from the studies of Spanish-English bilinguals. The contradiction between Cantonese-Putonghua bilinguals and Spanish-English bilinguals could be explained by the difference in complexity between the two languages in the bilinguals. As interference was created by the phonological contrasts between the two languages, the languages which were more divergent in syllabic structures, vowels and consonants system would be observed easier. (Watson, 1991) For Spanish and English, there were a lot of differences in syllabic structures, vowels and consonants systems, so phonological interference could be observed. Cantonese and Putonghua are the two phonologies with many similarities, it was hardly confirmed whether the error productions were assimilated to Cantonese or Putonghua phonology. For example, the bilingual produced /ʂ/ → [s] in Putonghua. It was hardly to judge whether the bilingual assimilated the phoneme to

Cantonese phonology or Putonghua phonology as the phoneme produced [s] occurred in both phonology. Ball (1984) supported the notion that the divergence of the two phonological systems in the bilinguals determined the existence of phonological interferences. He suggested that a Welsh dominant Welsh-English bilingual will not be very likely to show phonological interference as both languages possess a similar prosodic and syllabic structures, and vowels and consonants systems. The subsequent research in Welsh-English bilinguals supported the above notion, as phonological interference was not observed (Ball, Muller & Munro, 2001a & b). In conclusion, phonological interference was not observed in Cantonese and Putonghua due to the similarities in phonological structure, vowels and consonants systems.

It was hypothesized that the phonological development of dominant language should be faster than that of non-dominant language in bilinguals. This phenomenon, however, did not observe in this study. The post hoc comparisons of interaction effect of age and dominance in percentage phoneme correct did not reach statistical significance. The percentage phoneme correct of Cantonese was higher than that of Putonghua in all age groups regardless of language dominance. This finding contradicts with the finding of Fantini (1985) that the dominant language acquired faster than that of the non-dominant language in a simultaneous Spanish dominant Spanish-English bilingual. The differences in rate of phonological acquisition in bilinguals with different language dominance in the studies of Spanish-English and Cantonese-Putonghua bilingual could be explained by the difference of complexity in the phonological systems. Despite the more number of tones, Cantonese consists of less consonants and vowels when compared to Putonghua. Putonghua contains triphthongs and consonants in retroflex and alveolo-palatal places but Cantonese does not. The above differences showed that Cantonese is a simper phonological system when compared with Putonghua. As phonological acquisition is defined as the acquisition of phonological contrasts in phonemes, the rate of phonological acquisition would be faster in a simpler

phonology. The studies in monolingual Cantonese and Putonghua phonological developments also revealed that there were differences in rate of acquisition between Cantonese and Putonghua. (So & Dodd, 1995; Zhu & Dodd, 2000) Cantonese developed faster than Putonghua in monolinguals supported the notion that the more complex phonology developed slower than the simpler phonology. In summary, language dominance played a role in acquisition of phonology, but it was not the only factor determinating in the acquisition of two different phonologies as the complexity of phonological systems played a very important role. Because of the fact that the rate of phonological acquisition of a simpler phonological system would be faster than a more complex phonological system, it is rather difficult to predict that the dominant phonology would develop faster than the non-dominant phonology in a bilingual.

Conclusion

The developmental rate and patterns of Cantonese-Putonghua bilinguals with respective language backgrounds were documented. The research indicated that there was generally similar pathway of phonological acquisition in the bilinguals with different dominance in Cantonese and Putonghua. Cross-populational differences in rate of phonological acquisition, age of emergency of phonemes and phonological processes between the dominant and non-dominant bilinguals suggested that language background, which was determined by language input and extent of use, played a role in Cantonese, and Putonghua phonological acquisition. The extent of effect of language dominance in the phonological developments of the bilinguals was suggested. Because of the simpler phonological system would acquire faster than the more complex phonological systems, it is hard to predict that the dominant phonology would develop faster than the non-dominant phonology in a bilingual.

Clinical Implication

The study indicated that language background played a role in phonological acquisition in Cantonese- Putonghua bilingual. The developmental rate, phoneme emergency and

phonological processes were different in Cantonese dominant bilinguals and Putonghua dominant bilinguals. In the neutralist position of language disorders, the children were considered to be suffering from language delay and/or disorder when they perform differently from the norm (Fey, 1986). Speech therapists should determine the language background of the clients and select the appropriate norm of reference in order to increase the validity of diagnosis.

Further Research Direction

The present study investigated the phonological developments of Cantonese-Putonghua bilinguals with different language dominance aged from 2;06 to 4;11. The patterns of phonological development of bilinguals from birth to 2;05 has not been explored. Further research could be carried out in order to investigate the effect of language dominance and phonological interference in early phonological developments. As dominance plays a role in phonological acquisition, it is hypothesized that the treatment effectiveness of phonological disorders would be different when treatment is provided in dominant language and non-dominant language. It was important to investigate the effectiveness of phonological treatments provided in dominant and non-dominant language in order to provide theoretical and/or clinical directions in the treatments of bilingual phonological disorders.

Acknowledgements

I would like to express my deepest thank to Dr. Lydia So and Dr. Tara Whitehill for their valuable advice, comments and guidance. Their unflagging support and encouragement has helped to bring about the completion of this study. I could also thank my family, friends and fellow colleagues, especially Flora Chung, Carmen Fong and Dennis Hui, for the inspiration and endless support. Last by not least, I would like to thank all the participants, families of participants, and all the kindergartens for their help in subject recruitment and assessment room allocation.

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Appendix 1: Comparison of Cantonese and Putonghua phonology

	Cantonese	Putonghua
Tones	high level$_{(55)}$, high rise$_{(25)}$, mid level$_{(33)}$, low fall$_{(21)}$, low rise$_{(23)}$, and low level$_{(22)}$, high entering$_{(5)}$, mid entering $_{(3)}$, low entering$_{(2)}$	high level$_{(55)}$, high rising$_{(35)}$, falling rising$_{(214)}$, high falling$_{(51)}$
Vowels	i, ɪ, y, ɛ, œ, ɵ, ɐ, a, ʊ, ɔ, u	i, u, y, o, ɤ, ʌ, ə, ɛ, ɚ
	iu, au, ɐu, ou, ɔi, ui, ai, ɐi, ei, ɵy, ɛu	ae, ei, ao, oʊ, iʌ, iɛ, uʌ, uo, yɛ
		iɑo, ioʊ, uae, uei
Syllable initial consonants	p, p^h, t, t^h, k, k^h, k^w, k^{wh}	p, p^h, t, t^h, k, k^h
	m, n, ŋ	m,n
	f, s, h	f, s, ʂ, ɕ, x
	ts, ts^h	ts, ts^h, tʂ, tʂ^h, tɕ, tɕ^h
	l, j, w	l, ʐ
Syllable final consonants	p, t, k	n, ŋ
	m, n, ŋ	
Syllable structures	(C)V(C)	(C)V(C)

Appendix 2: Modified Language Background Scale (Cantonese and English version)

Instruction: The questions are about the language in which your child talk to different people, and the language in which certain people speak to you child. Please answer as honestly as possible. There is no right or wrong answer. Please tick in the correct box, and put a cross if a question does not fit your child's position.

指示. 以下問題關於小朋友在日常生活所用的語言分配情況. 問題並沒有"對" 或"錯", 請如實填寫. 請在適合的方格填在 "*", 如有不適用的問題, 請填上 "x".

Part A: In which language(s) do you child speak to the following people?

甲部. 小朋友用什麼語言跟以下人士對話?

	Always in Cantonese 最常用廣東話	More often in Cantonese 用廣東話比普通話多	Equally use two languages 平均地用兩種語言	More often in Putonghua 用普通話比廣東話多	Always in Putonghua 最常用普通話
Father 父親					
Mother 母親					
Brothers/Sister 兄弟姐妹					
Grandparents 祖父母					
Other Relatives 其他親戚					
Neighbors 鄰居					

Teachers 老師					
Friends in the Classroom 校內朋友					
Friends outside School 校外朋友					
Community 社區人士					

Part B: In which language(s) do the following people speak to you child?

乙部. 以下人士用什麼語言跟小朋友說話?

	Always in Cantonese 最常用廣東話	More often in Cantonese 用廣東話比普通話多	Equally use two languages 平均地用兩種語言	More often in Putonghua 用普通話比廣東話多	Always in Putonghua 最常用普通話
Father 父親					
Mother 母親					
Brothers/Sister 兄弟姐妹					
Grandparents 祖父母					
Other Relatives					

其他親戚					
Neighbors 鄰居					
Teachers 老師					
Friends in the Classroom 校內朋友					
Friends outside School 校外朋友					
Community 社區人士					

Part 3: Which Language does your child use with the following activities?

丙部. 小朋友進行以下活動時會用什麼語言?

	Always in Cantonese 最常用廣東話	More often in Cantonese 用廣東話比普通話多	Equally use two languages 平均地用兩種語言	More often in Putonghua 用普通話比廣東話多	Always in Putonghua 最常用普通話
Watching TV 看電視					
Listening to CDs 聽音樂					
Listening to Radio 聽收音機					
Shopping 購物					
Phoning 打電話					
Clubs 興趣小組					

End

完

Appendix 3. Phonological processes of Cantonese and Putonghua

The definition of phonological processes was discussed with one example of errors appeared in Cantonese dominant bilinguals and Putonghua dominant bilinguals. Cantonese was used to illustrate the processes that appeared in both Cantonese and Putonghua. Eight phonological processes were used in Cantonese and thirteen phonological processes were used in Putonghua in the Cantonese-Putonghua bilinguals.

i. Phonological processes in both Cantonese and Putonghua

1. *Assimilation.* Assimilation occurred when one or more distinctive features of a phoneme were transferred to other phonemes in the syllable such as syllable initial alveolar harmonize with syllable final alveolar.

   Cantonese dominant bilinguals: e.g. /pan$_{25}$ /→ [tan$_{25}$] in “腳” (foot).

   Putonghua dominant bilinguals: e.g. /ŋan$_{23}$/ → [nan$_{23}$] in “眼” (eye).

2. *Final consonant deletion.* Final consonant deletion occurred when the consonants in the final position of the syllable were missing.

   Cantonese dominant bilinguals: e.g. / ts^{h}ɔŋ$_{21}$/ → [ts^{h}ɔ$_{21}$] in “床” (bed).

   Putonghua dominant bilinguals: e.g. /k^{wh}ɐn$_{21}$/ → [k^{wh}ɐ$_{21}$] in “裙” (skirt).

3. *Stopping.* Stopping occurred when the phonemes realized as plosive at the correct place of articulation.

   Cantonese dominant bilinguals: e.g. /sɵy$_{25}$/ → [tɵy$_{25}$] in “水” (water).

   Putonghua dominant bilinguals: e.g. /fa$_{55}$/ → [pa$_{55}$] in “花” (flower).

4. *Fronting.* Fronting occurred when the phonemes substituted by other phonemes with the same manner but in the position nearer to the lip.

   Cantonese dominant bilinguals: e.g. /kɐi$_{55}$/ → [pɐi$_{55}$] in “ 雞”(chicken).

   Putonghua dominant bilinguals: e.g. /fa$_{55}$/ → [pa$_{55}$] in “花” (flower).

5. *De-aspiration*. De-aspiration occurred when the aspirated phonemes were produced as un-aspirated counterpart.

   Cantonese dominant bilinguals: e.g. / k^{wh}ɐn_{21}/ → [k^{w}ɐn_{21}] in “裙” (skirt).

   Putonghua dominant bilinguals: e.g. / t^{h}ɔ$ŋ_{25}$/ → [tɔ$ŋ_{25}$] in “糖” (candy).

6. *Affrication.* Affrication occurred when the fricatives were produced as affricates with the same place of articulation.

   Cantonese dominant bilinguals: e.g. /sɵy_{25}/ → [tsɵy_{25}] in “水” (water).

   Putonghua dominant bilinguals: e.g. /sɐi_{55}/ → [tsɐi_{55}] in “西” (west).

ii. Phonological processes in Cantonese

1. *Delabialization.* De-labialization of /k^{w}/ and /k^{wh}/ occurred when the labial feature was absent in the production.

   Cantonese dominant bilinguals: e.g. /k^{wh}ɐn_{21}/ → [k ɐn_{21}] in “裙” (skirt).

   Putonghua dominant bilinguals: e.g. /k^{w}ɐi_{55}/ → [kɐi_{55}] in “ 龜” (tortoise).

2. *Deaffrication.* Deaffrication occurred when the affricates were produced as fricatives with the same place of articulation.

   Cantonese dominant bilinguals: e.g. /tsiu_{55}/ → [siu_{55}] in “蕉” (banana).

   Putonghua dominant bilinguals: e.g. /ts^{h}ɔ$ŋ_{21}$/ → [sɔ$ŋ_{21}$] in “床” (bed).

iii. Phonological processes in Putonghua

1. *Initial consonant deletion.* Initial Consonant deletion (IC deletion) occurred when the initial consonants was not produced.

   Cantonese dominant bilinguals: e.g. /pei_{55}/ → [ei_{55}] in “杯” (cup).

   Putonghua dominant bilinguals: e.g. /niou_{35}/ → [iou_{35}] in “牛” (cow).

2. *Triphthong reduction.* Triphthong reduction occurred when the child realized triphthongs as diphthongs or vowels in their production.

Cantonese dominant bilinguals: e.g. / k^huai_{51}/ → [k^hai_{51}] in “快” (fast).

Putonghua dominant bilinguals: e.g. /$tsuei_{214}$/ → [$tsei_{214}$] in “嘴” (mouth).

3. *Diphthong reduction.* Diphthong reduction occurred when the diphthongs were reduced as the constituted vowels.

   Cantonese dominant bilinguals: e.g. /ɛia_{55}/ → [ɛa_{55}] in “蝦” (shrimp).

   Putonghua dominant bilinguals: e.g. /xua_{55}/ → [xa_{55}] in “花” (flower).

4. *Backing.* Backing occurred when the phonemes substituted by other phonemes with the same manner but in the position nearer to the velar.

   Cantonese dominant bilinguals: e.g. / m$ən_{35}$/ → [n$ən_{35}$] in “門” (door).

   Putonghua dominant bilinguals: e.g. /fei_{55}/ → [sei_{55}] in “飛” (fly).

5. *X-velarization.* X-velarization occurred when the children used the phoneme /x/ to replace other affricates and fricatives.

   Cantonese dominant bilinguals: e.g. /fei55/ → [xei55] in “飛” (fly).

   Putonghua dominant bilinguals: e.g. /ɛia_{55}/ → [xia_{55}] in “蝦” (shrimp).

6. *Gliding.* Gliding occurred when the phonemes were substituted by glides such as /j/.

   Cantonese dominant bilinguals: e.g. /ʐ$ən_{35}$/ → [j$ən_{35}$] in “人” (people).

   Putonghua dominant bilinguals: e.g. /ʐ$ən_{35}$/ → [j$ən_{35}$] in “人” (people).

7. *Aspiration.* Aspiration occurred when the unaspirated phonemes were produced as aspirated counterpart.

   Cantonese dominant bilinguals: e.g. /kou_{214}/ → [k^hou_{214}] in “狗” (dog).

   Putonghua dominant bilinguals: e.g. /pei_{55}/ → [p^hei_{55}] in “杯” (cup).