

**Phonological Acquisition in Three Languages:
A Cross-Sectional Study of English, Mandarin and Malay
Volume I**

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Abstract

The complex multiracial/multilingual situation of Malaysia poses challenges for local professionals, such as speech and language therapists, who work with children. The present cross-sectional study investigated ethnic Chinese children's simultaneous phonological acquisition of English, Mandarin and Malay, which are the three major local languages for the Malaysian Chinese population. The aims were to provide preliminary normative data on phonological acquisition for this population, as well as to investigate processes underlying multilingual phonological acquisition. Sixty-four pre-school children aged between 2;06-4;05 were recruited. A single-word naming test, a word consistency production sub-test and an intonation imitation sub-test were devised for each of the three languages. Particular attention was paid to the characteristics of the local adult speech varieties as the benchmark for assessing and analyzing the children's responses on the tests. This sociolinguistic dimension has often been neglected in previous research with similar populations, where non-local, e.g. "standard" adult varieties have been taken to be the language model for the children being studied. The children's phonological acquisition was analysed in terms of consonants, vowels, syllable structures, word production consistency, intonation and tones (Mandarin only). Overall, significant developmental trends were evident for all three languages. Most phonological components under study were acquired by 4;00-4;05. Similar phonological milestones were achieved as those reported in the literature for monolingual and bilingual peers acquiring the same languages, though some qualitative and quantitative differences were observed. Overall, the patterns of phonological development that were identified reflect the interaction of common cross-linguistic tendencies with the specific characteristics of the three ambient languages. As well as having clinical implications, the present findings contribute to the development of theory and models for multilingual phonological acquisition. The reliability and validity of the test battery indicate that it will prove a valuable tool for speech and language therapy practice and for future research.

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Conventions

CHICKEN, AYAM: spoken real word target/stimulus in English and Malay.

Ji1ROU4, XI2SHOU3: spoken real word target/stimulus in Mandarin, digits 1-4 refer to the four basic tones in Mandarin.

[tʃikən], [ajam], [tɕi1ɽou4]: spoken response, where phonetic information is required, in English, Malay and Mandarin.

“fish”, “ayam”: spoken response, where phonetic information is not required, in English and Malay.

“ji1rou4”: spoken response, where phonetic information is not required, in Mandarin (or Pinyin/spell sounds).

2;06: children’s chronological age i.e. two years and six months.

Source: Stackhouse & Wells (1997:xvii)

Abbreviations

ME: Malaysian English

MM: Malaysian Mandarin

CM: Chinese Malay

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Dedication

For Chong Ee, Yi Yan and Yi Shien

And,

In memory of my mother Chew Chor Eng

CHAPTER 1

INTRODUCTION

1.0 INTRODUCTION: PHONOLOGICAL DEVELOPMENT IN MULTILINGUAL COMMUNITIES

In the West, substantial research has been carried out on monolingual phonological acquisition, particularly of English. Bilingual phonological acquisition has received less attention (Fantini 1985; Watson, 1991), research on multilingual phonological acquisition being even rarer than research on bilingual acquisition (Lleo & Kehoe, 2002). This imbalance needs to be addressed for two main reasons. First, bilingualism and multilingualism are more typical than monolingualism (Fishman, 2002; Cook, 2003), and they are a necessity of everyday life for most populations in the world (Edwards, 1994; Romaine, 2004). Second, bilingual and multilingual studies may throw light on the fundamental processes of phonological development. For instance, a recent study showed that bilingual children are at an advantage in their phonological development, probably because of their better phonological awareness, auditory discrimination and phonological knowledge (Grech & Dodd, 2008). Data from both bilingual and multilingual children help to test theories and models of monolingual phonological acquisition (Zhu & Dodd, 2006b).

In Europe and North America, the majority of bilingualism studies have concentrated on minority groups or migrants learning their mother tongue in a predominantly English-speaking country (Gupta, 1994). The children of these populations are often exposed to two separate languages, each spoken by speakers who are primarily monolingual (Gupta, 1994). As a result, most studies of bilingual phonological acquisition have consisted of comparative analysis: the two separate developing phonological systems in the bilingual children are compared to the phonological development of monolingual children (Gupta, Brebner & Yeo, 1998). However, the language combinations under study so far have been limited (Arnberg, 1987; Zhu & Dodd, 2006b), and so the way in which specific languages may interact with one another is not clear (Arnberg, 1987). Commonly English is one of the languages in the pair, typologically different languages have been neglected (Ingram, 1981), and thus to what extent the closeness of the two phonological systems affects bilingual phonological acquisition is not known (Zhu & Dodd, 2006b).

As most of these studies have adopted a small-scale approach (Lleo & Kehoe, 2002), focusing mainly on the minority bilingual and multilingual groups that exist as a result of mixed marriages and global mobility, they are largely anecdotal and impressionistic, reflecting the strong emotional involvement of the researchers (Meisel, 2004). As McLaughlin (1984) has noted, there are methodological shortcomings of these observational studies. Particularly when one is observing one's own child, mistakes done by the child may be overlooked, for example, ill-formed patterns might be transformed into well-formed patterns; and the overall tendency is to support one's hypothesis and to ignore the rest. Factors such as linguistic history or input and exposure patterns have also been neglected (Romaine, 1995). As observational studies are fraught with methodological constraints, the main problem being lack of objectivity, many questions remain unanswered. For instance, to what extent does bilingual acquisition parallel monolingual acquisition in terms of pattern of development and rate of development? What relationship is there between the two languages? Do they develop independently or do they influence each other? What are the conditions under which languages influence each other (McLaughlin, 1984)?

Psycho-social effects and the limited amount of exposure that comes with learning a non-community language may sometimes affect the bilingual acquisition of the children in these studies. On the other hand, studies of the multilingual acquisition in the predominantly multilingual communities of Asia and Africa are rare (Barnes, 2006; De Houwer, 2009). In many countries of Asia and Africa, it is common to have a large section of the population speaking three or more languages. A commonly found combination is one or more local ethnic languages, plus another indigenous language which has been used as a lingua franca among different ethnic groups, and a foreign language which has been brought into the country during an earlier period of colonization and has later become the language of education and privilege in the country (Li, 2000).

One example of this is Malaysia, a country in South-East Asia, which is the context of the present study. Malay, English, Mandarin, Tamil are the four main languages, though other varieties of Chinese (e.g. Hokkien and Cantonese) and other Indian varieties (e.g. Telugu and Punjabi) are also found. The amount to which an individual is exposed to each of these languages, and the particular variety of each language that the individual is exposed to is to a large extent determined by the individual's ethnic background. For instance, a large section of the ethnic Chinese community speaks one or more local ethnic languages (Mandarin and Chinese dialect/s), plus another indigenous language (Malay) as a lingua franca to communicate with other ethnic groups such as ethnic Malay and Indian populations, and a foreign language (English) which was brought into Malaysia during the period of British colonisation. In this kind of multilingual learning context, psycho-social factors such as personality, motivation, attitude, style as well as amount of language exposure are more controlled, since the

languages under study are also used by the community at large. Also, as bilingual/multilingual acquisition studies offer cross-linguistic comparison within the same individual child, factors such as maturation and processing capacity are also more controlled (Meisel, 2001). This provides a unique opportunity to explore the more linguistic factors in language acquisition (Meisel, 2001; De Houwer, 2009). Barnes (2006) and De Houwer (2009) for instance have called for future large-scale studies on childhood multilingualism in Asia and Africa in order to come up with a model of multilingual language acquisition.

Another important difference between children from the minority bilingual groups (Gupta, 1994) and children from the multilingual communities (Barnes, 2006) mentioned above relates to the adult language varieties to which children are exposed in such multilingual communities. These are likely to be very different from the varieties spoken in the country where the language originated, having been subjected to processes of cross-linguistic influence and separate development over many years. This is the case in Malaysia, the context of the present research, for English, Mandarin and Malay. Moreover, such varieties are far less extensively described in the linguistic literature than, for example, the English of Britain or the USA; the varieties of Mandarin spoken in the Republic of China; or the Malay spoken by the ethnic Malays in Malaysia. For these reasons, in the present study of multilingual phonological acquisition, due consideration is given to sociolinguistic phonological variants in the adult input models. In a bilingual or multilingual language learning context or community where language transfer has occurred in the adult language model, it is essential to take account of these phonological variants in order to rule out the possibility of misinterpreting the bilingual child's phonological patterns as incorrect (Locke, 1983; Goldstein, 2000; Khattab, 2002, 2006; Donegan, 2002; Kehoe, 2002; De Houwer, 2009). The bilingual child may in fact be "showing rather direct effects of the perhaps less-than-normative input instead of creating transfer patterns that are not supported by their input models" (De Houwer, 2009:183).

As a result of the paucity of research, multilingual language acquisition is often considered as an extension of bilingual language acquisition (Hoffmann, 2001; Genesee, 2003; Wang, 2008). The bilingual child should not be deemed as two monolinguals; likewise, the multilingual child should not be seen as three monolinguals or three bilinguals (Grosjean, 1989; Cook, 1992; Wang, 2008). Just as bilingual acquisition ought to be studied in its own right (De Houwer, 2009), multilingual acquisition also needs to be studied in its own right (Hoffmann, 2001; Wang, 2008). Though the bilingual language development research so far suggests that bilingual children acquire language in ways much the same as monolingual children, it cannot be assumed that the same will be true for multilingual children (Wang, 2008; De Houwer, 2009). As Barnes (2006) has noted, multilingual children are processing three or more languages, not one or two like monolingual and bilingual children. According to the Dynamic Model of

Multilingualism, they should be holistically viewed as more competent users (Cook, 1992, 1995, 1996), who possess dynamically interacting language sub-systems which are subject to variations (Jessner, 1997, 2008; Herdina & Jessner, 2002). As with the cross-linguistic influences observed in the two languages of bilinguals, cross-linguistic influences of the three or more languages are anticipated in multilinguals. These cross-linguistic influences help to shed light on the acquisition processes in multilingual speakers. Comparison of language acquisition by multilinguals, monolinguals and bilinguals will help to reveal the similarities and differences that exist among these populations (De Houwer, 1995).

1.1 THE NEED FOR RESEARCH INTO MULTILINGUAL PHONOLOGICAL ACQUISITION IN MALAYSIA

One important reason to carry out research on phonological development in Malaysia is to meet the needs of children who grow up with spoken language difficulties. As the field of speech-language pathology is relatively young in Malaysia, the local speech-language pathologists are facing challenges of a lack of speech-language assessment tools, including phonological tests. Some language tests have been adapted from English, for instance, “The MacArthur Communicative Development Inventory” (Fenson, Dale, Reznick, Thal, Bates, Hartung, Pethick & Reilly, 1993). Currently the most common assessment criterion used is communicative competence, i.e. whether a child can express his needs, whether a child uses any language to express himself, rather than linguistic competence (Lian & Abdullah, 2001), e.g. whether a child’s phonological abilities are within the normal limits. There is a pressing need for research that will directly benefit the local speech-language pathologists and other relevant professions working with children, such as teachers, psychologists and audiologists.

The highly complex sociolinguistic situation in Malaysia has complicated the development of speech-language assessment diagnostic tools. In Malaysia, most Malays are bilingual Malay-English. Most Chinese and Indians are multilingual: Mandarin, Chinese dialects, Malay and English for Chinese; and Tamil, Indian dialects, Malay and English for Indians. In short, the majority of Malaysians are at least bilingual if not multilingual in three or more languages. Therefore, speech-language pathologists dealing with this particular population need to deal with their three languages. Multilingual speech-language assessment tools are in high demand, as currently there are none. Devising a multilingual phonological assessment tool is a starting point for research towards developing multilingual diagnostic tools more widely.

Furthermore, parents sometimes worry about their children having to cope with so many languages and dialects. Particularly with English, Mandarin and Malay in the Chinese primary school, they sometimes wonder whether this will delay the child's language development. Studies of multilingual phonological development will help to describe the developmental path(s) taken by multilingual children, providing evidence as to whether these parental worries are warranted.

In Malaysia, there have been few substantial monolingual phonological acquisition studies, let alone bilingual or multilingual phonological acquisition studies. Several small-scale studies have appeared since the mid 1990s, following the establishment of the first academic Speech Sciences degree programme in the capital city Kuala Lumpur (see Chapter 4). These local studies have focused mainly on monolingual phonological acquisition in three of the four major local languages, namely: English, Mandarin and Malay, plus one Southern Chinese dialect i.e. Cantonese (see Chapter 4). These studies have involved children from all three major ethnic groups: Malay, Chinese and Indian. Such studies include phonological acquisition of English by Chinese children (Ng, 1999) and Indian children (Pamela, 2000), phonological acquisition of Mandarin by Chinese children (Oo, 2001; Lim, 2002), phonological acquisition of Malay by Malay children (Badruzaman, Lim & Sandra, 1999), and Cantonese phonological acquisition by Chinese children (Yoon, 2001). Only one study has been carried out on bilingual Chinese children's English and Mandarin phonological acquisition (Lim, 2004). However, these studies have suffered from certain shortcomings. The number of participants in most of these studies was small. The majority of these studies have only concentrated on consonant acquisition, while other core aspects of phonology such as vowels, syllable structures, and tones (for Mandarin) have been neglected. The input models have been neglected and the scoring criteria are often poorly-defined. In addition, the children's second language, third language and home dialects were not taken into account (see Chapter 4). As the review of research presented earlier in this chapter indicates, when analysing children's phonological development in one language it is important to take account of their other languages and dialects.

1.2 OVERVIEW OF THE THESIS

Aiming to fill some of these gaps, the present study investigates 64 pre-school Malaysian Chinese children's phonological development in their three major local languages, namely English, Mandarin and Malay. Taking account of eventual practical applications as well as theoretical considerations, this study aims to develop a clinical phonological test suitable for use with local multilingual children, with its own local standard multilingual phonological norms. The study also aimed to examine whether the local multilingual children developed their phonology in ways similar to monolingual and bilingual children described in previous research, in terms of rate of acquisition, speech accuracy and error

patterns. Since differences which arise may be due to the effects of multilingual acquisition, the cross-linguistic influences among the three languages are examined, and the possible underlying processes and influencing factors are also explored. By using a cross-sectional group rather than a case study design, individual variation is controlled for. The amount of language exposure is also controlled to some degree by controlling for chronological age (2;06-4;05)(Kehoe, 2002).

The child participants are representative of the pre-school Chinese population in the country, who generally are more proficient in English and Mandarin than in Malay, a language which they pick up in their nursery school. The usual situation is that these children learn English and/or Mandarin simultaneously from home, and Malay successively from pre-school. Their acquisition of the three languages can be defined as simultaneous acquisition of English and Mandarin and successive acquisition of Malay (see Chapter 5). However, as they have fairly early exposure to Malay, and their learning of the three languages falls within the primary language development period (Genesee, 1993; Genesee & Nicoladis, 2008), their acquisition of the three languages can be loosely defined as simultaneous acquisition. It is hard to determine with confidence whether their L1 and L2 is English or Mandarin, as these are the two languages commonly used in the Chinese home, as the medium of instruction in the Chinese nursery, mass media, and by the Chinese community at large. The children's proficient usage of these two languages was evident in for example, their frequent simultaneous usage of translation equivalents when they were not asked for, when responding to the phonological naming tests (c.f. Grech & Dodd, 2008). This is further complicated by some of them having some exposure to some Chinese dialects at home. It is hard to identify language dominance among the languages and dialects used by the multilingual speakers in many multilingual communities in Asia (Lim, Rickard Liow, Lincoln, Chan & Onslow, 2008). Code-switching and code-mixing are predominant speech styles for all races in Malaysia (Rosmawati, 1999; Aini Rozita, 2000; Cheng, 2003). Observation in local speech therapy clinics suggests that parents are often uncertain of the child's proportionate usage of their dominant languages (e.g. English vs. Mandarin) when they are interviewed about the child's linguistic background information (c.f. Grech & Dodd, 2008). Furthermore, their estimates of their child's proportionate language use may not reflect the child's true phonological repertoire (Goldstein, Fabiano & Washington, 2005).

In the present study, it is assumed that children growing up in this multilingual language learning context receive a roughly similar pattern of exposure to their three languages, i.e. even though the absolute exposure, for all the children, will be less for Malay, the relative amount of exposure to the three languages will not vary greatly among the children. If the proportion of input in all three languages is indeed roughly similar, one would expect that the best performing children in

one language, in terms of production accuracy of consonants, vowels etc. will also perform best in the other two languages (Baskaran, 2004; Pearson, Fernandez, Lewedeg & Oller, 1997). This would be manifested by a significant correlation in the children's performance across the three languages. In this case, it can be inferred that the children are drawn from a relatively homogeneous and stable socio-linguistic group. On the other hand, if the children vary in the amount of exposure to each of their three languages, one would expect differences across language performance on their production accuracy of consonants, vowels etc. For instance, one child's score would be better for English consonants than for Mandarin or Malay consonants, as he has received more input in English than the other two languages; whereas another child's score would be higher for Mandarin than for Malay and English because he has received less input in English than in Mandarin. This issue will be investigated statistically, using partial correlation analysis (see Chapter 6).

The organisation of the thesis is as followed: Chapter 1 outlines the theoretical and practical background to the present investigation, and sets out the aims and the research questions. Chapter 2 reviews relevant studies on monolingual and multilingual phonological acquisition, highlighting theoretical and methodological issues. Chapter 3 describes the local socio-linguistic situation and the local language varieties, in particular their phonologies. Chapter 4 describes previous studies of phonological development in Malaysian children. Chapter 5 describes the methodology of the main study, including the development of a phonological test battery that incorporates relevant sociolinguistic information about the child participants and about the adult language varieties. Chapter 6 presents quantitative analysis of the results in order to address the main hypotheses about phonological acquisition, as well as the validity of the test tools. Chapter 7 interprets the results of the present findings qualitatively, in terms of age of acquisition, developmental patterns of phonological simplification, making comparison with previous findings for monolingual and bilingual children described in the literature. Chapter 8 reviews previous cross-linguistic research on intonation development, highlighting theoretical issues, describes the intonation sub-study in the present research, interprets the results and discusses the findings, as well as the limitations of the study. Chapter 9 discusses the quantitative and qualitative results presented in Chapters 6 and 7. The main themes are: cross-linguistic similarities and differences, cross-linguistic influences, underlying processes and factors influencing multilingual phonological acquisition, as well as the theoretical implications of the findings. Chapter 10 summarises the findings, discusses the clinical implications of the study, and proposes recommendations for future studies.

1.3 AIMS OF STUDY

General Aim

To investigate the degree to which multilingual children's phonological development resembles that of monolingual and bilingual children.

Specific Aims

1. To describe the phonology of the local varieties of the three main languages that ethnic Chinese children are typically exposed to in the pre-school years, namely: English (Manglish), Mandarin (Maldarin) and Malay (ChinMalay).
2. To devise a phonological test battery that takes account of these local phonologies and that is culturally appropriate and age-appropriate for the children.
3. To describe the multilingual phonological acquisition of ethnic Chinese children in Malaysia from age 2;06-4;06, as measured by performance on the above phonological test battery in a cross-sectional group study of 64 children.
4. To compare the phonological acquisition of multilingual ethnic Chinese Malaysian children with that of monolingual and bilingual children as described in previous research.

1.4 RESEARCH QUESTIONS

1. How does accuracy of production develop from age 2;06-4;05, in each of the three languages?
2. How does consistency of word production develop from age 2;06-4;05, in each of the three languages?
3. Is there a significant relationship among the three languages for production accuracy?
4. Is there a significant relationship among the three languages for consistency of word production?
5. What are the developmental patterns of the three phonologies being acquired by the multilingual children, each from age 2;06 to 4;05?
6. What cross-linguistic similarities and differences are evident in the multilingual children's phonological acquisition?
7. Is there any evidence of cross-linguistic influences in the multilingual children's phonological production?
8. What other factors may affect multilingual children's phonological acquisition?
9. What are the theoretical implications of these results for the understanding of multilingual phonological acquisition?

The first four research questions will be explored using statistical analysis (see Chapter 6). The fifth research question will be explored using qualitative analysis (see Chapter 7). The last four research questions are addressed through discussion of the present findings in the light of previous research (see Chapter 9).

CHAPTER 2

PHONOLOGICAL DEVELOPMENT

2.0 INTRODUCTION

In this chapter, the theoretical aspects of bilingual and multilingual phonological acquisition will be discussed. Past studies of bilingual and multilingual phonological acquisition relevant to the present study will be reviewed in the sections on models and factors of bilingual and multilingual phonological acquisition. Past studies on monolingual phonological acquisition in English, Mandarin and Cantonese will also be described.

2.1 PHONOLOGICAL DEVELOPMENT IN BILINGUAL AND MULTILINGUAL CHILDREN

Broadly speaking, there are two types of bilingual acquisition: *simultaneous* and *successive*, the latter referring to the sequential acquisition of two languages, normally beginning with the home language, followed by a second language when the child starts school (Yavas, 1998). The acquisition of a second language in a natural environment is said to be different from that of classroom learning (McLaughlin, 1984; Heredia & Brown, 2004). There is a controversy over the cut-off age to distinguish simultaneous acquisition from successive acquisition. Some researchers have adopted stringent cut-off age criteria for simultaneous acquisition namely: regular exposure to two languages from birth (Padilla & Lind Holm, 1984; Arnberg, 1987; De Houwer, 1990, 2009) or, from birth to one year (Deuchar & Quay, 2000). Other researchers have favoured more lenient cut-off age criteria: exposure to two languages before age three (McLaughlin, 1984) or, three to four (Meisel, 2004), or four to five (the “primary language development” period)(Genesee, 1993; Genesee & Nicoladis, 2008) constitutes simultaneous acquisition while exposure to a second language after the said ages constitutes successive acquisition. The term “Bilingual First Language Acquisition” (BFLA) is widely used to refer to the simultaneous acquisition of two languages from birth (Meisel, 1989; De Houwer, 1990, 2009; Genesee & Nicoladis, 2008). The term “Child Second Language Acquisition” is used to refer to acquisition of a second or additional language from five to ten, and “Adult Second Language Acquisition”, after ten (Meisel, 2004). Other broader terms used in the literature include: “Early Bilingualism” to refer to all of the above (Barnes, 2006) i.e. generally the early acquisition of two languages in childhood (Li, 2000); and “Second Language Acquisition” (SLA) to cover all types of language acquisition except for first language acquisition. This includes for instance, an adult learning a language which is not their mother tongue e.g. learning to read Mandarin in the

university, or a child learning a new language after migrating to a new country. The latter is often investigated under the field of bilingual development, and is thought of a sub-discipline of SLA (Archibald, 1998). In general, most SLA research is concerned with adults (e.g. Ioup & Weinberger, 1987; Archibald, 1998; Hansen Edwards & Zampini, 2008). The typology of bilingualism is reviewed by Edwards (2004) and Butler & Hakuta (2004).

On the other hand, the term “Early Multilingualism” is used for exposure to three or more languages from birth, which is fairly common in Asia and Africa, and which is increasingly common in Europe due to global mobility and mixed marriages (Barnes, 2006). Barnes (2006) reviewed the literature and claimed that the pattern of multilingual acquisition is complex, depending largely on language input and use. One possible pattern of acquisition is the simultaneous acquisition of three languages in different situations. For example, each parent speaks to the child in one language at home i.e. “one-parent-one-language”, the so-called rule of Grammont, named after the person who proposed the rule (Ronjat, 1913), and a third language is used in the school or community. Other possible acquisition orders are influenced by acquiring different languages at different times. For example, simultaneous acquisition of two home languages followed by successive acquisition of a third language at pre-school. The multilingual acquisition patterns become more complex when four or more languages are involved.

The difficulties of precise definition are well illustrated by the children who participated in the present study. The typical acquisition order for the participating children, as established by home language usage profile via parental verbal report (see Appendix 1 & Chapter 5) is that English and/or Mandarin is commonly being the first and/or second home languages followed by Malay, a third language in the pre-school. In addition, 39% of the children had some exposure to Chinese dialects at home. 31% of the children had some exposure to Malay because of their live-in Indonesian domestic maid (see Appendix 1 & Chapter 5). Given the heterogeneous backgrounds, where in some Chinese homes the conversation goes on in one to three languages/dialects, with a significant amount of code-switching and code-mixing, it is therefore hard to distinguish a definite L1 or L2 (Pillai, 2006; see also Makoni, 2008). They are simultaneous learners of three languages plus/minus one dialect based on the lenient chronological age criteria (Genesee, 1993; Genesee & Nicoladis, 2008; Meisel, 2004), but successive learners based on the one or two home languages follow by a second or third school language definition (Yavas, 1998; Cenoz, 2000; Barnes, 2006). Depending on their immediate environments, some of the children may also be aware of Tamil- the Indian language spoken by the third largest ethnic group in the country, though the typical pattern is that ethnic Chinese do not understand or speak Tamil, likewise ethnic Indians do not understand or speak Mandarin/or other Chinese dialects (see further discussion in Chapter 3). Malay (the national language) or English (the compulsory second language in education) is often used as a lingua

franca between these two ethnic groups (see Chapter 1 & Chapter 3). The fifth type of multilingualism described by Hoffmann (2001) seems to summarise the type of multilingualism the children subjects in the present study involved best, albeit with a slight modification of the term “trilingual” to “multilingual”:

1. Trilingual children who are brought up with two home languages which are different from the one spoken in the wider community;
2. Children who grow up in a bilingual community and whose home language (either that of one or both parents) is different from the community languages;
3. Third language learners, that is, bilinguals who acquired a third language in the school context;
4. Bilinguals who have become trilingual through immigration, and
5. Members of trilingual communities.

(cited from Hoffmann, 2001:3).

In the present literature review and the present thesis as a whole, the term “multilingual(ism)” is employed as a cover term for acquisition of three or more languages while the term “bilingual(ism)” is used for acquisition of two languages only. The term “second language acquisition” (SLA) is used for bilingual acquisition in adults.

2.1.1 Introduction to bilingual and multilingual acquisition

Cross-linguistic research has expanded rapidly in the past three decades. This kind of research helps to deepen our knowledge of the language acquisition process, distinguishing features that are more universal (for phonology, e.g. using an unmarked feature such as an unaspirated sound to replace a more marked feature, an aspirated sound), from features that are more language specific (e.g. /r/ is commonly realized as [w] by children learning English but as [j] by children learning Mandarin)(Slobin, 1985; Ingram, 2008; Zhu & Dodd, 2006c; Zhu, 2009). The similarities and differences in the cross-linguistic developmental patterns identified in these studies can be used as a baseline for clinical diagnosis (Zhu, 2009). Studies of bilingual and multilingual phonological acquisition help to test existing phonological acquisition theories that look at developmental universal patterns such as “law of irreversible solidarity” (Jakobson, 1941/68), markedness (Edwards, 1974; Dinnsen, 1992), biological and articulation constraints (Locke, 1980; 1983), and those that look at language specificity such as functional load (Pye, Ingram & List, 1987) and phonological saliency (Zhu & Dodd, 2000; Zhu, 2002; Zhu, 2009).

Research into bilingual and multilingual language acquisition has lagged behind research into monolingual language acquisition. Until the late 1970s, bilingual and multilingual language acquisition studies were rare. There were just a few influential early bilingual language acquisition studies before this: the bilingual French/German case study by Ronjat (1913), and the bilingual English/German case study by Leopold (1939-1949, 1970). In 1978, focusing on morpho-syntactical development, Volterra & Taeschner (1978) reported two bilingual Italian/German girls' initial fusion (mixing) of their two languages before the languages became separated. This language separation issue provoked a long-standing debate in the field of bilingualism over the following two decades (e.g. Ingram, 1981/2; Genesee, 1989, 2000b; Meisel, 1989, 2000; De Houwer, 1990; Yavas, 1995).

Language mixing during the early stages of bilingual acquisition has been interpreted as a unitary language system with undifferentiated syntactical, lexical and phonological systems (Genesee, 1989, 2000b). It was argued that bilingual children are monolingual before the age of three and that they become true bilingual only after around the age of three (Genesee, 2003). Today, this Unitary Model or Fusion Hypothesis Model is disputed (Genesee, 1989, 2000b; Meisel, 1989, 2000; De Houwer, 1990). The bilingual child's lexical mixing is for instance, argued to be a result of over-extensions and under-extensions- rather similar to acquisition processes/strategies commonly observed in monolingual children. One other main criticism on the Unitary Model or Fusion Hypothesis Model was that the role of "input" that the bilingual child received was not considered by researchers (Genesee, 1989, 2000b, 2003). The bilingual child was claimed to mix up the two languages manifested by their productive mixed utterances. However, it can be argued that the bilingual child's mixed utterances might be a product of the direct influences of the mixed input models provided by the adults in his immediate linguistic environments e.g. code-mixing and code-switching for meta-communicative purposes such as to assert ethnic identity and to establish interpersonal intimacy (Saunders, 1988; Genesee, 1989, 2000b, 1993, 2003; Genesee & Nicoladis, 2008; Goodz, 1989a, 1989b; De Houwer, 1990; Bentahila & Davies, 1994; Nicoladis & Genesee, 1996; Quay, 2008). Currently, the more widely accepted views are the Differentiation Hypothesis and Autonomous Development Hypothesis (Meisel, 2001). According to the Differentiation Hypothesis, the bilingual child differentiates the two languages from early on, whilst according to the Autonomous Development Hypothesis the bilingual child follows a similar pathway to a monolingual child in the two respective languages.

Thus far, research into multilingual language acquisition has concentrated mainly on adults (e.g. Clyne, 1997; Cenoz, Hufeisen & Jessner, 2003), and is commonly about educational issues (e.g. Cenoz, Hufeisen & Jessner, 2000). Empirical studies on early multilingualism have just begun to emerge (Barnes, 2006; De

Houwer, 2009), though since the 1960s, there have only been about a dozen descriptive studies (Barnes, 2006). These consist of small-scale case studies (e.g. Hoffmann, 1985; Dewaele, 2000; Quay, 2001, 2008; Maneva, 2004; Barnes, 2006; Cruz-Ferreira, 2006; Wang, 2008; Yang & Zhu, in press; and the six studies reviewed in Quay, 2001). With the exception of Yang & Zhu (in press) who focus on phonological aspects, these case studies have focused mainly on morpho-syntax and socio-pragmatics, with little or no descriptive description on phonology. As a result, multilingual phonological acquisition is an under-explored area. In the future, cross-sectional studies using a larger number of subjects are desirable, in order to investigate the similarities and differences in the acquisition processes that exist between these multilingual children and monolingual and bilingual children (De Houwer, 1995)(see Chapter 1).

2.1.2 Theoretical perspectives of bilingual and multilingual acquisition

De Houwer (1990) has addressed four important theoretical issues in bilingual language acquisition:

1. The degree to which bilingual language development resembles monolingual language development.
2. Does the bilingual child develop one or two language systems?
3. The role of input in bilingual language development.
4. Psycholinguistic explanations of bilingual language development (see also Genesee, 1993).

The first two issues will be reviewed in this section, while the last two will be reviewed under “factors affecting bilingual and multilingual phonological acquisition” in section 2.1.3).

2.1.2.1 Bilingual and multilingual vs. monolingual acquisition

Bilingual language acquisition theories are centred round the same basic principles as monolingual language acquisition theories, namely: rate of acquisition, patterns of acquisition, and processes of acquisition (Genesee, 1993, 2003; Genesee & Nicoladis, 2008). Theories of language acquisition generally aim to describe the child’s manifested linguistic behaviours and to uncover the implicit underlying linguistic, cognitive and social processes (Genesee, 1993, 2003). The primary interest in bilingual language acquisition is to find out if the developmental path and course of the bilinguals is similar to that of monolinguals acquiring the same languages: a delay in the rate of acquisition by the bilinguals

will be attributed to the burden of learning an additional language, and any differences in the developmental patterns will shed light on the underlying processes of a dual language input (Genesee & Nicoladis, 2008). Bilingual language acquisition is affected both by factors influencing monolingual acquisition and by bilingual-specific factors such as unequal amount of exposure or extent of use in each language and cross-linguistic influences (Genesee & Nicoladis, 2008). As bilingual language acquisition studies allow cross-linguistic comparison within the same individual child, researchers have been able to explore the linguistic factors with other contributing factors such as individual maturation, processing capacity and personality being controlled (Meisel, 2001). Bilingual language development is fundamentally the same as monolingual language development (Genesee, 1993, 2003; De Houwer, 1995, 2009; Barnes, 2006; Wang, 2008) since there are no differences in the learner's language acquisition device, pre-linguistic knowledge, world knowledge and cognition skills (Genesee, 1993, 2003). The essential bilingual language developmental milestones are generally reached at about the same ages as for monolinguals (De Houwer, 1995, 2009; Meisel, 2001; Genesee, 2003; Genesee & Nicoladis, 2008). However, some differences are anticipated since the bilingual child is learning two languages whilst the monolingual child only one (Genesee, 1993; Bunta, Davidovich & Ingram, 2006; Barnes, 2006; Wang, 2008; De Houwer, 2009). In bilingual language acquisition theories however, there are additional perspectives, for instance: Whether learning two languages simultaneously or successively will affect the patterns and processes of language acquisition? Whether there are interactions between the two languages which give rise to different acquisition patterns than the monolinguals? Whether there are specific interaction effects between specific language combinations (Genesee, 1993)?

2.1.2.2 One phonological system or two?

The last two decades have seen an upsurge in research into bilingual phonological acquisition (e.g. Yavas, 1995; Johnson & Lancaster, 1998; Holm & Dodd, 1999b; Paradis, 2001; Johnson & Wilson, 2002; Khatlab, 2002, 2006; Kehoe, 2002; Vihman, 2002; Kesahvarz & Ingram, 2002; Brulard & Carr, 2003; Bunta et al., 2006; Law & So, 2006; studies compiled in Zhu & Dodd, 2006a; Grech & Dodd, 2008). Virtually all these studies have, in some way, compared the bilingual phonological acquisition with the monolingual. The issue of whether or not the child uses one system or two in the course of phonological development has received less attention, as it has to a greater extent in studies of lexical development.

Early research showed that the development of one or two phonological systems seems to be affected partly by the pattern of bilingual language acquisition i.e. simultaneous acquisition or successive acquisition (Zhu & Dodd, 2006b). Some early simultaneous acquisition studies have reported an initial single phonological

system (Burling, 1959/1978; Leopold, 1939-1949, 1970; Vogel, 1975; Schnitzer & Krasinski, 1994; Yavas, 1995). Other early successive acquisition studies have reported superimposition of a known phonological system onto the unknown phonological system (Fantini, 1985). The theoretical issue of “one system or two?” in the seventies has been challenged mainly on ground of pragmatic awareness/separation of the two languages (Genesee, 1989, 1993, 2000)(see section 2.1.1). Keshavarz & Ingram (2002) critically reviewed Leopold’s (1939-1949) classical data on his daughter, Hildegard’s early consonantal inventories consisting of six consonants: /m, n, b, d, h, w/- these same consonants were used for words from both German and English leading to the conclusion of a single-phonology system. They argued that the bilingual child may be well aware of the existence of two different languages, but still chooses to select sounds from one of the two languages, or to select unmarked sounds from the two languages, or to select shared sounds from the two languages (Keshavarz & Ingram, 2002); or it might also be due to a lack of language-specific sounds at that particular developmental stage (Paradis, 2001).

Currently, the most widely accepted view, supported by the findings of the majority of the recent empirical studies is that, the child uses two separate phonological systems, though there is still the question of whether each develops in an independent (autonomous) or dependent (interactive) fashion (Lleo & Kehoe, 2002; Bunta et al., 2006). Most recent studies, whether of simultaneous or successive acquisition, have reported two separate phonological systems which do not develop entirely autonomously, but have various cross-linguistic influences on each other, resulting in some differences in the developmental patterns compared to those of monolingual children in the same languages (e.g. Dodd, So & Li, 1996; Holm & Dodd, 1999b, 2006; Paradis, 1996, 2001; Ball, Muller & Munro, 2001, 2006; Johnson & Wilson, 2002; Keshavarz & Ingram, 2002; Bunta et al., 2006; Law & So, 2006; So & Leung, 2006; Yang & Zhu, in press). The specific language interaction effects, e.g. acceleration and delay, manifested by interference patterns or transfer patterns from one language to another have been scrutinised (Keshavarz & Ingram, 2002; Yang & Zhu, in press) and the factors influencing the direction of these interference patterns, e.g. input frequency/language dominance and markedness have been investigated by some researchers (Law & So, 2006; Lleo, 2002; Kehoe, 2002). The possible effects of specific language pairs in leading to specific phonological error patterns have generated some recent research interests (Zhu & Dodd, 2006a). Some other recent studies have however argued that bilinguals show rather similar phonological development patterns to those of monolinguals- the autonomous theory (De Houwer, 1995; Khattab, 2002, 2006; Goldstein, Fabiano & Washington, 2005; Yavas & Goldstein, 2006).

The controversial findings reported in the bilingual literature are perhaps not surprising owing to the heterogeneity of this population and the resultant methodological constraints (Johnson & Wilson, 2002; Kehoe, 2002; Khattab, 2006; Yavas & Goldstein, 2006) plus the problem that is inherent in the question itself (Khattab, 2006). Bilingual phonological development is subject to multiple influences i.e. factors influencing monolingual phonological development such as maturation of the vocal organs, which is more universal, as well as factors more specific to bilingual and multilingual phonological development such as unequal amount of input and extent of use in each of the languages and cross-linguistic transfer (Genesee & Nicoladis, 2008). There is also a controversy over the definition of a phonological system and its emergence, even in monolingual acquisition, for instance, how do we decide if a child has acquired English /t/ which varies in phonetic production across different word positions, and even within and across dialects (Khattab, 2006)? Khattab (2006) revised the concept of phonological system, widening its range by incorporating sociophonetic variation i.e. the variability in the speech input that a child is exposed to (see further discussion in section 2.1.3). Despite the growing knowledge in the field of bilingual phonological acquisition, unfortunately, very few studies have seriously considered the issue of input models mentioned above. This has sometimes resulted in the misinterpretation of normal bilingual phonological patterns as interference or transfer from one language to another (see further discussion in section 2.1.3).

Turning to multilingual acquisition, based on the few existing descriptive multilingual case studies, the emerging picture is that despite having to cope with three or more languages, multilingual children develop separate language systems including phonologies that are interacting with one another (Yang & Zhu, in press). Future studies on other language combinations are needed to validate this claim and to explore the processes underlying multilingual phonological acquisition.

2.1.2.3 Models of bilingual and multilingual phonological acquisition

To date, models of bilingual language acquisition are still largely dependent on models from second language acquisition (SLA) research. For example, Contrastive Analysis Hypothesis (Weinreich, 1953; Lado, 1957), Markedness Differential Hypothesis/Structural Conformity Hypothesis (Eckman, 1977, 1991), Ontogeny Model/Ontogeny & Phylogeny Model (Major, 1987, 2001) and Critical Age Hypothesis (Lenneberg, 1967; Singleton, 1989), with “transfer”, “universals” and “age of acquisition” being the three major constructs (Hansen Edwards & Zampini, 2008). There is not yet any well developed model of multilingual phonological acquisition. Lleo & Kehoe (2002) have called for more research into bilingual phonological acquisition in order to incorporate factors relevant to developmental phonology such as “input frequency” and “markedness” in

bilingual phonological acquisition models. These factors will be reviewed in the next section. In the rest of this chapter, more focus will be given to those recent studies which are more relevant to the present study in terms of age of subjects i.e. above two years, research design i.e. cross-sectional approach, and ethnicity of subjects i.e. ethnic Chinese children. Other case studies will also be reviewed where appropriate.

2.1.2.3.1 Evidence from studies of Chinese bilingual phonological acquisition

Several cross-sectional and longitudinal studies of successive bilingual Cantonese-English children have appeared since the 1990s (Dodd et al., 1996; Holm & Dodd, 1999b, 2006). These studies concentrated on minority groups or migrants in England (Dodd et al., 1996) and Australia (Holm & Dodd, 1999b, 2006), focusing on bilingual children between approximately two and five who had all received some exposure to Cantonese prior to English. The main findings derived from all these studies are that though the pre-school bilingual Cantonese-English children developed separate phonological systems, they also showed both quantitative and qualitative differences in their phonological development compared to that of monolingual children (c.f. So & Dodd, 1995 for Cantonese, and Grunwell, 1982 for English). Evidence of two phonological systems can be seen in their use of the following segments and error patterns:

1. Shared segments used in one language before the other.
2. Language-specific segments not used in the “wrong language”.
3. Same segments simplified differently in each language (e.g. stopping /s/ → [d] in English, but affricating /s/ → [ts] in Cantonese).
4. Added segments never violate the phonotactic rules of each language (e.g. /blu/ → [bluf] in English, /ji/ → [jik] in Cantonese but not [jif] because final /f/ is illegal in Cantonese).
5. Contradictory error patterns used for each language (e.g. fronting /k/ → [t] in English, but backing /t/ → [k] in Cantonese).

Overall, their phonetic development was concluded to be similar to that of monolingual children, with rather similar orders and similar times for both languages. Shared segments were stimulable in both languages. Holm & Dodd (1999b, 2006) attributed this finding to articulatory maturation responsible for the approximately simultaneous emergence of segments in both languages. The speech accuracy of the bilingual children in Cantonese was also found comparable to that of the monolingual children. However, their speech in

English was found to be less accurate than that of monolingual English children, as well as less accurate than their own their Cantonese. This was attributed to their longer exposure to Cantonese i.e. one to three years before exposure to English (Holm & Dodd, 2006).

In addition to quantitative differences found in speech accuracy when compared to that of monolinguals, qualitative differences were also found in their phonological development, manifested in their usage of a higher amount of delayed and atypical error patterns alongside typical error patterns. The typical errors in the four studies are: cluster reduction, final consonant deletion, stopping, fronting, deaffrication, affrication, deaspiration, consonant harmony, continuant variation, reduplication and backing final consonant in Cantonese; and cluster reduction, final consonant deletion, stopping, fronting, deaffrication, gliding, weak syllable deletion, consonant harmony and voicing in English. The delayed error patterns are defined as typical monolingual error patterns used by monolingual children of a younger age, whereas the atypical errors are defined as error patterns used by less than 10% of the monolingual children, that are associated with phonological disorder in monolingual children. The 10% cut-off point is based on the incidence figures of English developmental speech disorders (Zhu & Dodd, 2006c). The main atypical error patterns identified in the four studies are: backing, voicing, initial consonant deletion, aspiration, gliding and addition in Cantonese; and backing, initial consonant deletion, voicing, affrication, addition, nasalization and frication in English. Other more minor atypical errors are: final consonant deletion in Cantonese, and, deaspiration, non-release of final consonants and transposition in English. The nature of these atypical errors was claimed to be more inconsistent and transient than normal error patterns and delayed error patterns.

Holm & Dodd, (1999b) present a longitudinal case study of two children, while Holm & Dodd, (2006) includes a report of a longitudinal case study that partially recapitulates their earlier article. These longitudinal studies focus on two bilingual children, aged between 2;03-3;01 and 2;09-3;05. It was found that atypical error patterns in Cantonese were only evident subsequent to the acquisition of the second language, English. For instance, atypical errors such as aspiration in Cantonese were used at 2;08, in one child, only when she began to speak in English spontaneously (Holm & Dodd, 1999b). This indicates that the two developing phonological systems are interacting i.e. the bilingual acquisition affects the first phonological system. Using the psycholinguistic assessment model for normal as well as disordered phonology by Duggirala & Dodd (1991) and Dodd & McCormack (1995)(a more updated version)(see Appendix 2), Dodd & Holm (1999b, 2006) explained the underlying acquisition processes of these atypical phonological patterns in the bilingual children as “underspecified phonological rules” commonly observed in phonological disordered children. According to this model, the child first selects a word from his lexicon to express

his ideas in producing speech, the lexical phonological specification is then fed through the existing set of realization rules to form a phonological plan for production. Realisation rules are derived from information in the lexicon, reflecting an implicit understanding of the nature of the phonological structure in the child's ambient language. A child with a phonological disorder faces challenges of abstracting knowledge about the nature of his developing ambient phonological system. Atypical error patterns occur when the child selects the wrong parameters of the speech signals salient to his ambient phonology. The successive bilingual Cantonese-English children are not phonologically disordered, yet they have exhibited error patterns that are atypical for monolinguals. Their atypical errors are associated with a failure in processing their two phonologies in sufficient detail in order to select language-specific realization rules. The inconsistent and transient nature of their atypical errors indicates that as the children received more exposure in English, they learned to differentiate the realization rules of their two phonological systems better. For example, unreleased final consonants in English were a product of Cantonese influence, with increasing exposure to English however, the children then learned to identify the salient characteristics of English phonology i.e. unlike Cantonese, English final consonants are usually released. As a second example, virtually all atypical errors in Cantonese as well as in English were outgrown at 3;01 in the above child who has started using atypical errors from 2;08.

This underspecification, manifested in both overgeneralization of phonological rules across languages and within each language is evident in many of the atypical patterns. For example, variation between /l/ and /n/ (i.e. [l] can be used for /l/ and /n/) is sometimes acceptable in Cantonese, but had been overgeneralised to /j/→[n], /w/→[l] in the bilingual children. As a further example, deletion of initial /ŋ, h/ is sometimes acceptable in Cantonese, but had been overgeneralised to a wide range of initial consonants in Cantonese (within language) as well as in English (across languages). As a final example, the addition of an initial consonant is sometimes acceptable in Cantonese, provided it is glottal stop or the same as the final consonant of the preceding word but this had been overgeneralised to a wide range of initial and final consonants. The atypical error patterns are usually language-specific, they are claimed to be the product of interference effects due to the specific language combination. As the number of children using these atypical errors was great, these errors are described as "normal bilingual" error patterns (Dodd et al., 1996; Holm & Dodd, 1999b, 2006). Future studies on successive bilingual children learning other language pairs are needed in order to validate this finding (Holm & Dodd, 1999b, 2006).

This psycholinguistic model of bilingual phonological acquisition is useful, as it explains, and not merely describes, the error patterns plus the plausible underlying bilingual acquisition processes which are responsible for them (Dodd, 2005). However, the interpretation of some of the erroneous data described in the above

empirical studies is not completely reliable, owing to the methodological shortcoming of not taking into account of input language models when analysing the children's speech output (see Chapter 1). For example, "deaspiration" i.e. deaspirating aspirated sounds (Holm & Dodd, 2006) and not releasing final plosives and other final consonants (Holm & Dodd, 1999b) in English are interpreted as erroneous patterns. However, these phonological features are commonly produced by adult Chinese speakers with Southern Chinese dialect background, as phonological variants of standard English phonology (see Platt, 1982; Kortmann & Schneider, 2004 & Chapter 3). In the first cross-sectional study, Dodd et al. (1996:128) said that: "Cantonese was the primary language spoken at home for all children, but they were also exposed to English since one or both parents and elder siblings sometimes addressed the children in English"; and in the case study, Holm & Dodd (1999b:353/2006:296) said that: "When Catherine started attending childcare the family began to include some English in their home language environment". However, the linguistic background of the parents was not elaborated on. One might query whether the parents in these studies, who had lived in Hong Kong for years before migrating to England and Australia are likely to speak English with a Chinese accent. For this reason one cannot be sure that aspiration and non-release of final consonants are developmental patterns, rather than not a product of direct influences of adult accent. On the other hand, the phonological variants in adult Cantonese (e.g. variation between /l/ and /n/, initial deletion of /ŋ, h/ etc.) were taken into account in the data analysis (Holm & Dodd, 1999b; Holm & Dodd, 2006). One might argue that this imbalance in analytical procedures could be in part responsible for the claimed finding that the bilingual children were more accurate in Cantonese than in English. This imbalance is also evident in studies of bilingual Cantonese-Putonghua children such as Law & So (2006)(see next section).

Vowel errors were, surprisingly, far more prevalent than for monolingual children, with 26.15% English vowel errors reported in Dodd et al. (1996), and "thirty one of the forty children made vowel errors..." in Holm & Dodd (2006:290), although it is not clear whether the latter refers to English vowels, Cantonese vowels or both English and Cantonese vowels. Unfortunately, examples of vowel error patterns were not given in either study, nor further explained or discussed. One might query that the pervasive English vowels errors are probably a product of adult input influences and not developmental errors. This misinterpretation of vowel variants as vowel errors became even more evident in another bilingual Cantonese-Putonghua study (So & Leung, 2006)(see next section).

Despite these shortcomings, the findings of qualitative and quantitative differences exist in the bilingual Cantonese-English population and monolingual population has contributed useful information to the literature of bilingual phonological acquisition in ethnic Chinese children.

2.1.2.3.2 Other studies on Chinese bilingual and multilingual phonological acquisition

These findings on bilingual Cantonese-English children are further supported by a cross-sectional study of forty bilingual Cantonese-Putonghua children of a rather similar age range in Shenzhen, an immigrant city in Southern China (So & Leung, 2006). However, the bilingual Cantonese-Putonghua children in this study are generally delayed in their phonological development compared to monolinguals in each language, although the bilingual children acquired some consonants earlier than monolinguals i.e. only in Putonghua affricates /tʂ, tʂʰ/ and liquid /l/, probably owing to the increased exposure to these shared consonants in Cantonese. The order of consonant acquisition was reported to resemble that of monolinguals in both languages. The retroflex approximant /ʐ/ (cf. /ɻ/ in Table 3.3) in Putonghua was acquired late compared to monolinguals. Triphthongs in Putonghua were acquired surprisingly late, at 3;05, and vowel errors were still present at 5;00. The bilingual children were reported to use “Cantonese vowels when speaking Putonghua and Putonghua vowels when speaking Cantonese” (So & Leung, 2006:426). In addition to typical error patterns, the bilingual children showed more delayed and atypical error patterns than that of monolingual children. The atypical error patterns identified are: backing, initial consonant deletion, gliding, aspiration, frication and final glide deletion in Cantonese; and final consonant deletion, deaffrication and nasalization in Putonghua.

So & Leung (2006) did not make it explicitly clear which studies of monolingual children, each for Cantonese and Putonghua, they had used in their comparison analysis, though the references of So (1992) for Cantonese, and So & Zhou (2000) for Putonghua, which had turned up later in the report were likely to be the comparison sources. Final consonant deletion in Putonghua would be considered as a normal error pattern if the monolingual study by Zhu (2002, 2006b)(see Table 2.10 in section 2.2.2) had been used as a comparison source. Four of their atypical errors in Cantonese namely: backing, initial consonant deletion, gliding and aspiration were also evident in the above studies of bilingual Cantonese-English children, reflecting a bilingual influence from the second language (i.e. English and Putonghua) on Cantonese. Tones in Cantonese were acquired early, only 5% of the children were found to make any tonal errors. Tonal acquisition in Putonghua was not reported. This finding is inconsistent with another cross-sectional study on 100 bilingual Cantonese-Putonghua children in Shenzhen and Hong Kong by the first author with another researcher (Law & So, 2006), which focused on language dominance effects over bilingual phonological acquisition

(see section 2.1.3). The data in Law & So (2006) revealed that the rate and pattern of phonological acquisition by these bilingual children were commensurate with monolingual children including an absence of atypical errors. Unfortunately, no explanations were provided for the discrepancies which existed between this study (Law & So, 2006) and the study by So & Leung (2006), though one might think that it is probably due to methodological differences (e.g. different versions of test in each language was used in the two studies).

So & Leung (2006) explained their data in terms of the interference effects between the two languages. For example, the late acquisition of consonant clusters /kw, k^hw/ in Cantonese was attributed to interference from Putonghua, since there are no consonant clusters in Putonghua. Likewise, the late acquisition of retroflex /ʐ/ and the four triphthongs /uai, uei, iau, iou/ in Putonghua were attributed to interference from Cantonese, since both retroflex /ʐ/ and triphthongs are not present in the Cantonese phonological system. Deretroflexion in Putonghua was attributed to a transfer pattern from Cantonese. They have also associated the bilingual children's general phonological delay in both languages with a "less exposure to each language compared to monolingual children of either language" (So & Leung, 2006:424). Putonghua was acquired faster than Cantonese, which according to them, was because of a greater amount of use, since it is the official language in China, it is used in school, and so it is the dominant language for most children in China.

The preliminary findings contributed by this bilingual study of a pair of two Chinese tonal languages have no doubt provided useful information to the current limited literature of bilingual Chinese phonological development. However, as with the above bilingual Cantonese-English studies, this study is fraught with methodological problems. The language model of the bilingual children i.e. Putonghua spoken in Southern China which is subject to dialectal influences, was not taken into account when analyzing the data, manifested in ill-defined scoring criteria to distinguish correct production from incorrect production. There was a lack of information in considering the Southern Putonghua accent, which is crucial in a study of phonological development of its kind (Anthony, Bogle, Ingram & McIsaac, 1971; Grunwell, 1985; Dodd, Holm, Zhu & Crosbie, 2003), particularly since the sociolinguistic context involved is complex. The phonological features of Putonghua (Mandarin) speakers with Southern Chinese dialect backgrounds are well described (e.g. Chen, 1983, 1986; Ng, 1985; Lock, 1989; Yao, 1999; Yew, 1999; Wee, 2002; Lim, 2004). For instance, the retroflex affricates, fricative and approximant /tʂ, tʂ^h, ʂ, ʐ(z)/ are often replaced by the alveolar affricates, fricative and approximant [ts, ts^h, s]; the triphthongs /ueɪ/ is often realized as [ui] or [ue], and the /iou/ is often realised as [iu] or [io]. It was not clear whether these features were considered as acceptable productions. So & Leung (2006) have attributed deretroflexion in Putonghua as a transfer

pattern from Cantonese. However it can be argued that deretroflexion is a direct influence of the adult phonological variants, and not a transfer pattern that is not supported by their input model (De Houwer, 2009)(see Chapter 1). Further, one of the three atypical errors in Putonghua i.e. nasalization /l/→[n] is also a fairly common Southern Chinese phonological feature (e.g. Chen, 1983, 1986; Yao, 1999; Yew, 1999; Wee, 2002)(see Chapter 3). Unfortunately, examples of nasalization were not given. The late acquisition of triphthongs in Putonghua was also thought to be an influence from Cantonese. Vowel errors were surprisingly pervasive, 40% of the oldest children aged 5;00 and above were still making vowel errors, the children were said to use “Cantonese vowels when speaking Putonghua and Putonghua vowels when speaking Cantonese” (So & Leung, 2006:426). Unfortunately, apart from the monophthong substitution error pattern i.e. /o/→[u], detailed examples of the vowel error patterns particularly the triphthongs and the vowel exchanges between the two languages were not given. One might argue that these vowel errors are likely to be a product of sociolinguistic phonological variants rather than developmental errors. This misinterpretation of variants as developmental errors in Putonghua is probably responsible in part for the bilingual children’s delayed phonological development. Future studies are desired to validate the findings of this study.

Further, the linguistic background questionnaires indicated that the bilingual children generally exhibited equal amounts of language input and extent of use in both languages namely: 70% of the children’s families used both languages to communicate with them at home and 50% of the children used both languages at home. Since 70% of the children used Putonghua to communicate with their peers and all children used Putonghua in school, Putonghua seems the more dominant language. However, Cantonese is clearly also a fairly dominant language, evident in the name for the bilingual children in the report title: “Phonological development of Cantonese-Putonghua bilingual children” (So & Leung, 2006:413) i.e. “Cantonese-Putonghua” and not “Putonghua-Cantonese”. Despite the apparently adequate amount of input in both languages, So and Leung (2006) associated the bilingual children’s general phonological delay in both languages with “less exposure to each language compared to monolingual children of either language” (So & Leung, 2006:424). This view that input in dual languages automatically results in less input in each of the languages has been rejected (De Houwer, 2009). De Houwer (2009) argues that the bilingual child does not necessarily have less input in each language compared to monolinguals, as the amount of input depends not on the number of languages the child hears, but on the amount of time available for talking and the speaking rates of the child’s interlocutor (see further discussion in section 2.1.3). There are even examples of counter-evidence that the bilingual children may hear more of each language than monolingual children do (De Houwer, 2009).

Turning to multilingual phonological acquisition, the case study by Yang & Zhu (in press) on a young multilingual child aged 1;03-2;00 involved two Chinese languages i.e. Mandarin (Taiwan) and Hokkien (Southern Chinese dialect) alongside Spanish. The child was learning these three languages in the context of Paraguay as a result of mixed marriage. The researchers reported a few atypical errors in the child's Mandarin and Spanish, though the child's phonological patterns are commensurate with monolingual development in each language. The Taiwanese Mandarin accent was considered in the data analysis, for example the child's use of free variation among /ɹ/, /l/ and /r/ in Mandarin and Hokkien. However, it is not clear why the child's use of /y/→[i] in Mandarin, a prominent phonological variant commonly found in Mandarin speakers with Southern Chinese dialect background such as Taiwanese (Chen, 1983; Yew, 1999) was classified as an atypical error pattern. This phonological variant could be a direct influence from the child's mother and grandmother who both speak Mandarin and Taiwanese. Even if the mother and grandmother did both pronounce /y/ in the standard form, there is another confounding factor, namely the universal tendency to use an unmarked feature to replace a marked feature- in this case the front rounded vowel is marked compared to the front unrounded vowel (see Yavas, 1998 & further discussion in section 2.1.3). Yang & Zhu (in press) concluded that the child has differentiated the three languages at an early age with some cross-linguistic influences, and that multilingual phonological acquisition is complex, being subjected to multiple influences such as amount of input and extent of use and phonological saliency. This kind of multilingual phonological acquisition research is useful as it sheds light on the complex language acquisition process. However, as with all single case studies, generalisation is rather limited, since there may be individual variation factors i.e. individual sound preferences or individual acquisition strategies guiding the developmental path (Vihman, 1998).

2.1.3 Factors affecting bilingual and multilingual phonological acquisition

Bilingual and multilingual phonological development is subject to multiple influences which involve both monolingual acquisition factors as well as bilingual and multilingual acquisition factors (Genesee & Nicoladis, 2008)(see section 2.1.2.1). These factors will now be discussed.

Chronological age

Developmental factors and psychosocial factors such as chronological age, gender, socioeconomic status and personality are said to influence phonological development (Bernthal & Bankson, 1998). The positive effect of age is also supported by many other cross-sectional studies, successive as well as simultaneous where Mandarin is not one of the languages in the pair: Spanish-English (Yavas & Goldstein, 2006), Welsh-English (Ball, Muller & Munro, 2006), Arabic-English (Khattab, 2006), Maltese-English (Grech & Dodd, 2008).

Such findings indicate that it is important to have age norms of phonological acquisition in clinical phonological test tool, since age is an important contributing factor in phonological development.

Gender

For years researchers have been interested in investigating the relationship of gender and phonological development. Several cross-sectional monolingual phonological acquisition studies have reported gender differences only in the older age groups between 4;00 to 7;00 (Poole, 1934; Smit, Hand, Freilinger, Bernthal & Bird, 1990; Dodd et al., 2003). This has probably resulted in the non-consideration of gender effects in most bilingual phonological acquisition studies. The bilingual Cantonese-English study by Holm & Dodd (2006) (see section 2.1.2.3.1) has reported no statistically significant gender effects. The bilingual Welsh-English study by Ball, Muller & Munro (2001, 2006), also reported overall no statistically significant gender effects except for two Welsh fricatives /χ/ and /ʒ/. The Mandarin phonological acquisition study of bilingual ethnic Chinese children in Malaysia (Lim, 2002), the context of the present study (see Chapter 4), has also reported no statistically significant gender differences. The review so far implies that though in some studies girls outperformed boys at certain ages, gender is generally not a significant contributing factor in phonological acquisition compared to chronological age. It is therefore not necessary to have separate gender norms in phonological assessment.

Socioeconomic status

Likewise, comparing to age factor, socioeconomic status is also reported as a less significant contributing factor in phonological acquisition (Dodd, 2005). Cross-sectional studies by Smit et al. (1990) and Dodd et al. (2003) have all found no significant socio-economic effect on phonological development. This finding implies that it is not crucial to include separate norms for socioeconomic status in a phonological test.

Personality

Psychosocial factors such as the attitude towards bilingualism and multilingualism of the child's parents and of those people surrounding the child particularly teachers and peers, the child's own personality and attitude towards bilingualism and multilingualism (e.g. the child's fear of being isolated from others for speaking in a foreign language) are observed to affect language acquisition in children growing up in non-bilingual or non-multilingual community setting (e.g. Hoffmann, 1985; Maneva, 2004; Cruz-Ferreira, 2006; De Houwer, 2009). These psychosocial factors are more controlled in children

growing up in a bilingual or multilingual community setting, and thus allow exploration of the more linguistic factors affecting children's language acquisition (Meisel, 2001; De Houwer, 2009).

Linguistic factors

Universal constraints and language-specific patterns are claimed to affect phonological development. In this section, some theories accounting for universal and language-specific patterns will be discussed: markedness (Edwards, 1974; Dinnsen, 1992), "law of irreversible solidarity" (Jakobson, 1941/68) and, biological and articulation constraints (Locke, 1980; 1983) that look at universal patterns; as well as functional load (Pye, Ingram & List, 1987) and phonological saliency (Zhu & Dodd, 2000; Zhu, 2002; Zhu, 2009) that look at language specific-patterns.

For years, there has been a debate over the definitions and approaches to markedness (Battistella, 1990), one example of which is, the frequency of occurrence (distribution) among the world languages. This is known as typological markedness (Greenberg, 1976). According to typological markedness, there is an implicational relationship: the presence of one feature (marked) implies the presence of another (unmarked), but not vice versa. The term 'unmarked' refers to something basic, natural or common (Eckman, 2008). Yavas (1998) reviewed the individual sound inventories of the world's languages in terms of markedness, and reported the following findings: voiceless obstruents (stop and fricative) are generally more common than voiced obstruents. However, whether an obstruent sound is marked or unmarked is determined by the context in which it is involved. For example, voicing of an obstruent in both intervocalic and postnasal positions is unmarked. On the other hand, sonorants (nasals, liquids, and glides) are more common than obstruents in word final positions. In terms of the role of sonorants in phonological acquisition, nasals and glides are claimed to be unmarked early acquired sounds whereas liquids are more challenging and marked. Front unrounded vowels /i, e/ are more common than their rounded counterparts /y, ø/, which are marked. CV syllable structure is unmarked, whereas all other syllable structures are marked. The degree of markedness for a syllable is said to increase with the more consonants in a string: CVC is more marked than CV, but is less marked than CCV, CCVC, CVCC and so on.

Yavas (1998) further added that both segments and syllables can be put on a continuum of markedness and explained in terms of degree of articulatory ease, acoustic power and duration. For example, stops are more commonly found in bilabial, dental/alveolar and velar than palatal and palato-alveolar places of articulation because the abrupt release of stops is easier in bilabial and dental/alveolar than in palatal and palato-alveolar. Another example is that /s/ is the most common fricative because it is most salient, with mid-to-high frequencies in energy concentration, adequate acoustic power (9.2 dB), longest duration (129ms) and the least difficulty in recognition compared to other fricatives. Features or sounds that children acquire early are unmarked, while those that are acquired late are marked, children used unmarked features to replace marked counterparts. For example, using unmarked [ʃ] to replace marked /tʃ/ (deaffrication) in English (Dodd et al., 2003), and using unmarked deaspirated [t] to replace marked /t^h/ (deaspiration) in Putonghua (Zhu, 2002), using consonant cluster reduction or final consonant deletion to achieve an unmarked CV syllable in English (Dodd et al., 2003). Markedness is said to influence the direction of cross-linguistic interaction in bilingual German-Spanish bilinguals acquiring complex prosodic structures (Lleo, 2002)(see also Kehoe, 2002). However markedness has been criticized for not being able to account for the discrepancies in the age of acquisition for affricates across languages such as English and Japanese (Zhu & Dodd, 2000). On the other hand, markedness is also said to be responsible for some universal patterns in adults (Eckman, 1977, 2008), the most well-cited universal patterns in second language acquisition (SLA) being: final obstruent devoicing (e.g. /g/→[k]) and liquid substitution (e.g. /r/→[l]). These features are also evident in Malaysian English (Manglish), one of the languages being acquired by the children in the present study; in fact /r/→[l] is also evident in Mandarin and Malay, the children's two other languages. Examples of other patterns observed in the adults of the present study include: deaspiration in English and Mandarin, final /l/ deletion in English, substitution of front unrounded vowel for its rounded counterpart /y/→[i] in Mandarin (see Chapter 3). The Markedness Differential Hypothesis (MDH) (Eckman, 1977) has gained support from many SLA studies (Eckman, 1991; Eckman & Iverson, 1994; Carlisle, 1997, 1998; Cichoki, House, Kinloch & Lister, 1999). It is important to take note of these universal patterns in adults which, as well as a phonological transfer, contribute to the characteristic features of bilingual phonological development.

Another aspect of markedness that has been proposed is the Sonority Sequencing Principle (SSP) governing the occurrence of consonant clusters in word initial and final positions (Selkirk, 1984). Under this principle, segments preceding and/or following the syllable nucleus should be progressively decreasing in sonority values (cited from Yavas, 1998:184):

Onset

Nucleus

Coda

Stop > fricative > nasal > liquid > vowel > liquid > nasal > fricative > stop

According to this, initial clusters such as /pl/, /fr/ and /sm/ are examples of possible sequences, but not the reverse sequences /lp/, /rf/ and /ms/. Hogg & McCully (1987) proposed a 10 point-sonority scale:

Table 2.1: Sonority scale

Sound	Sonority value
Low vowel	10
Mid vowel	9
High vowel	8
Flap	7
Lateral	6
Nasal	5
Voiced fricative	4
Voiceless fricative	3
Voiced stop	2
Voiceless stop	1

Source: Hogg & McCully (1987:33).

Glides and affricates are excluded from Table 2.1. Glides should be placed in the same column as high vowels, as they are the non-syllabic version of high vowels, they shared the similar sonority value i.e. 8. Affricates are made up of a stop phase and fricative phase, and so they should be placed in between the stop and fricative columns (Yavas, 1998), carrying a sonority value of 2.5.

Two factors are said to govern this sonority scale: the degree of oral cavity opening in producing the sound, and the sound's propensity for voicing. The bigger the oral cavity opening, the greater the sonority value the sound has. If the degree of oral cavity opening is the same, the voiced sound should have a greater sonority value than its voiceless counterpart. The appeal of sonority is not merely to distinguish unmarked from marked, but also to distinguish the relative degree of markedness. The greater the sonority distance is between the first and the second segment in a cluster, the more unmarked the cluster will become. For example, /pl/ is more unmarked than /fr/ because of its greater sonority distance value i.e. from 1 to 6 (comparing to from 3 to 7). SSP been has been supported by phonological studies of both monolingual as well as bilingual children (Yavas, 2003; Yavas & Goldstein, 2006).

Studies of markedness in generative phonology (Singh, 1976; Blache, 1978) have focused on feature acquisition. The distinctive feature system highlighted the articulatory differences among segments such as consonants and vowels (Chomsky & Halle, 1968). For example: features which distinguish consonants from vowels are described as: sonorant, vocalic and consonantal. Features which distinguish segments in terms of place of articulation: anterior, coronal, high, low, back and rounded. Features which distinguish segments in terms of manner of articulation: nasal, lateral, continuant, delayed release and strident. The unmarked or basic features should be acquired before the marked or complex features. The features of aspiration (So & Dodd, 1995) and affrication (Olmstead, 1971; Prather, Hedrick & Kern, 1975) have been reported as acquired late. The late acquisition of the features of aspiration and affrication in Mandarin (Putonghua) (Zhu & Dodd, 2000)(see further discussion in section 2.2.2) seems to support this claim. The feature of retroflexion in Mandarin (Putonghua) has also been reported as acquired late (Zhu & Dodd, 2000).

In fact, developmental universals were generally first proposed by Jakobson (1941/68) in his “law of irreversible solidarity”. Under this theory, phonological development is said to follow a universal and innate order of acquisition. Children acquire phonology by learning contrasts or distinctive features in a predictable order i.e. first between consonants and vowels, then oral and nasals, followed by bilabial and dental. Children learn these contrasts in a fixed order, and sounds that occur most frequently in world languages will be acquired first. According to this, nasals, front consonants and stops that occur in virtually all world languages would be acquired earlier than orals, back consonants and fricatives. Jakobson’s (1941/68) prediction has been supported by cross-linguistic studies in many languages such as English (e.g. Prather et al., 1975) and Mandarin (Jeng, 1979). However, recent cross-linguistic studies (e.g. Zhu & Dodd, 2006b) have challenged Jakobson’s prediction with two main criticisms: it fails to account for individual variation among children acquiring the same language, and cross-language variation in the acquisition of the same sound. For example, fricatives /f/ and /s/ were acquired at different ages in languages such as Putonghua and Turkish (Zhu & Dodd, 2006c).

Another theory that is concerned with developmental universals is natural phonology, proposed by Stampe (1969, 1979). In natural phonology, children are said to have an innate and universal set of phonological processes. A phonological process is defined as “a mental operation that applies in speech to substitute, for a class of sounds or sound sequences presenting a common difficulty to the speech capacity of the individual, an alternative class identical but lacking in the difficult property” (Stampe, 1979:1). Thus, phonological processes reflect innate capabilities and limitations of vocal production and speech perception, these innate and universal processes correspond to the regularities found in the world languages (Vihman, 1998). Children suppress, limit and order

these innate and universal processes so that their pronunciation moves closer to the adult targets. For example, final obstruent devoicing (e.g. /v/→[f]) is a common phonological process evidenced in many world languages including British English; a British English-speaking child would have to suppress this process in order to match the adult target. However, in a non-native English variety such as Malaysian English (Manglish), the language being acquired by the multilingual children in the present study, final /v/→[f] is commonly found in the adult pronunciation, therefore Malaysian children do not necessarily have to suppress it (c.f. Vihman, 1998). Natural phonology enjoyed much popularity in the 1970s and 1980s: utilising the concept of phonological processes, various clinical assessment procedures have been proposed (e.g. Ingram, 1976, 1981; Weiner, 1979; Shriberg & Kwiatkowski, 1980). Phonological processes are clinically useful in describing, identifying and classifying normal and disordered phonological patterns across various languages (Grunwell, 1997). Even today, phonological process analysis is still widely used in clinical assessment procedure (e.g. Dodd, Zhu, Crosbie, Holm & Ozanne, 2002 for British English) as well as research analysis, including the present study (see Chapter 7), in describing the mismatched patterns found in between a child's pronunciation and the adult pronunciation. However, phonological processes have been criticized for a lack of explanatory power unlike psycholinguistic model (Dodd & McCormack, 1995; Dodd, 2005)(see further discussion on “psycholinguistic factors” later in this section).

Contrary to “markedness” and “law of irreversible solidarity” which focused on the innate abilities in phonological acquisition, the “biological model” (Locke, 1980, 1983) and the “articulatory complexity model” (Kent, 1992) focused on the articulatory and perceptual abilities in phonological acquisition. Locke (1980; 1983) claimed that infants shared the same universal phonetic repertoires which are subject to the size and shape of the vocal tract, and the relevant neuromotor control for articulation. There are three mechanisms in phonological development: maintenance, learning and loss. Once children have come through the babbling stage, and have started acquiring an ambient phonology, some of the sounds in their babbling repertoires are maintained, whilst other sounds that are beyond their babbling repertoires are learnt through their linguistic exposure. Sounds that are not in the babblings repertoires, but in the ambient phonology must be relinquished and lost. Kent (1992) proposed a link between the degree of motor control to that of ease and difficulty of articulation. As Zhu & Dodd (2006b) have commented, though the articulatory and perceptual constraints seemed to play a role in the babbling and early word stages, they have played a lesser part beyond speech onset. This is because they failed to account for individual variation in acquiring a particular sound as well as cross-language variation in acquiring sounds.

The theory of functional load was proposed to account for language variation in the order of consonant acquisition. Pye et al. (1987) reported that /l/ and /tʃ/ are acquired earlier in Quiche than English because of their greater functional load. Functional load is defined as the relative importance of a consonant within a specific phonological system. However, the calculation of functional load is controversial. Pye et. al (1987) defined the functional load of a consonant by its frequency of occurrence in minimal pairs. They claimed that /ŋ/ has a lower functional load than /m/ in English because /ŋ/ does not occur word initially and so it has a smaller number of oppositions in minimal pairs. Ingram (2008) claimed that significant correlations are found between the frequency of occurrence of a consonant and the number of word types the consonant occurs in. Therefore the more words a consonant occurs in, the more likely it is to be acquired. One simple example is English /s/ as opposed to /ʒ/- the former occurs frequently in English and therefore is acquired early, whereas the latter occurs less frequently in English and is restricted in coda position only and therefore is acquired late. Functional load concerns type frequency and not token frequency, for example, English /ð/ is low in functional load as it only occurs in article and pronouns such as *the*, *this* and *that* though these words occur frequently in English, therefore it is acquired late (Ingram, 2008). However, there is counter-evidence of functional load for instance, in Putonghua, /n/ has a greater functional load than /ŋ/ as the latter does not occur word-initially, however /ŋ/ is acquired earlier than /n/ (Zhu & Dodd, 2000). Functional load has been criticized for its exclusion of other core phonological aspects such as vowels, syllable structures and tones for tonal languages e.g. Mandarin and Cantonese (So & Dodd, 1995; Zhu, 2002; Zhu & Dodd, 2006b). Despite the weaknesses, functional load has contributed to the literature with regards to the importance of looking at relationship between the order of consonant acquisition and the role of consonants in an ambient language (Zhu, 2002).

In more recent developments, rather than talking about developmental universals, a different language-specific approach has been proposed to account for language variation or individual variation in phonological acquisition, both in terms of order of acquisition and age of acquisition, which developmental universal theories failed to explain. The basic concept of this approach is phonological saliency, which was developed to account for the specific developmental patterns observed in Putonghua-speaking children in China (Zhu & Dodd, 2000; Zhu, 2002). Phonological saliency is a syllable-based and language-specific concept, which takes into account the role of each syllable in carrying and distinguishing lexical information. Saliency is defined by three features:

1. The more capable the syllable is in distinguishing lexical meaning the more salient it is and the earlier it is acquired.
2. A compulsory syllable is more salient than an optional one and therefore it is acquired earlier.
3. The higher the number of permissible choices in a syllable the less salient it is and the later it is acquired.

This concept explains the finding from Putonghua that tone was acquired the earliest: this is attributable to the small number of terms (four) in the tonal system, plus its compulsory status in a syllable to distinguish lexical meaning. The syllable-final consonant is second most salient because of its small number (two), but unlike tone it is optional in a syllable, therefore it is acquired after tone. Vowels are compulsory in a syllable but because of the large number (21) the vowel is less salient than tone, and so it is acquired after tone as well. Syllable-initial consonants are the least salient of all four, because of their large number (21) and their optional status in a syllable. They are acquired last.

Phonological saliency is also supported by developmental data from Cantonese (So & Dodd, 1995; So & Leung, 2006), another Chinese language which has a comparable format (Zhu, 2009). It also accounts for multilingual acquisition data in Spanish, Mandarin and Taiwanese (Hokkien) by a young multilingual child (Yang & Zhu, in press). The multilingual child received more exposure in Spanish than Mandarin and Taiwanese; it is therefore not surprising that he developed Spanish phonology fastest among the three languages. However his slightly faster acquisition rate in Taiwanese than in Mandarin, plus his highest speech accuracy in Taiwanese among all three languages is surprising since he received least input in Taiwanese. This finding can be attributed to phonological saliency: Taiwanese has the least number of consonants (16) compared to Mandarin (19) and Spanish (19), and so it is most salient, and therefore its consonants are acquired earlier than Mandarin (but not Spanish due to another factor- amount of input). The importance of looking at specific language effects is also evident from another recent case study on a two-year-old bilingual English-Hungarian child (Bunta et al., 2006), in which case, moving close to adult targets in each ambient language (target-driven hypothesis) is said to be as important as increasing word complexity (constraint-driven hypothesis)(see also Ingram, 2008 for cross-linguistic evidence supporting language-based effects on early phonological development).

Psycholinguistic factors

Speech perception skill, oro-motor skill and cognitive-linguistic ability are claimed to be important factors underlying phonological development in children (Bernthal & Bankson, 1998). The ability to speak intelligibly is governed by a complex set of mental operations (Dodd, 2005). Psycholinguistic models of the speech processing chain (e.g. Dodd & McCormack, 1995; Stackhouse & Wells, 1997)(see Appendix 2 & 3) illustrate that children must be able to hear, discriminate specific-language phonemic distinctions, store words accurately in memory, adduce regularities in the ambient phonological system (phonological knowledge), apply phonological and phonetic constraints in speech output, and execute complex fine-motor actions (Dodd, 2005). One example of phonological knowledge is that a multilingual English-Mandarin-Malay child knows that consonant cluster such as /p_l/ does not occur in word initial position in Mandarin and Malay, but it does occur in English. Through psycholinguistic models of the speech processing chain, the researchers have been able to map the interactions among input (speech perception), cognitive-linguistic mental processes (phonological processes) and output (oro-motor)(Dodd, 2005)(see Chapter 9).

New-born infants are said to be innately endowed with auditory discrimination abilities, both segmental and supra-segmental. They show a preference for their mother's voice within a day of birth (Mehler, Bertoncini, Barriere and Jassik-Gershenfeld, 1978). They show an ability to distinguish native language from foreign language, even when only prosodic cues are left after other aspects of the signal have been filtered out (Mehler, Jusczyk, Lambertz, Halsted, Bertoncini & Amiel-Tison, 1988). They have also demonstrated an ability to discriminate segmental contrasts that exist both within and beyond their native language (Jusczyk, 1985; 1992). However, by the age of two, they lose the ability to discriminate non-native segments, their auditory discrimination having been affected by exposure to the ambient phonological system (Thyer, Hickson, Dodd, 2000). Likewise, bilingual infants must possess such abilities in order to acquire two languages simultaneously (Genesee, 1993). Recent cross-linguistic studies show that young bilinguals can discriminate their two languages at the same age as the monolingual in each language. Examples of the bilingual language pairs under investigation in these studies are: Catalan-Spanish (Bosch & Sebastian-Galles, 2001, 2003), English-French (Fennell, Byers-Heinlein & Werker, 2007; Sundara, Polka & Molnar, 2008) and English-Mandarin (Fennell et al., 2007).

In fact, one recent study (Grech & Dodd, 2008) indicates that bilingual children from a bilingual community might be at an advantage for phonological acquisition compared to monolingual children. However, monolingual children from a bilingual community might be at an advantage for phonological acquisition compared to monolingual children from a non-bilingual community. This is probably because children in a bilingual learning context have to

constantly discriminate more than one language phonologically including languages that they do not know so as to ensure what they hear is worth attention. This in turn may increase their phonological awareness of constraints in each ambient phonological system, leading to better phonological knowledge. This study involved 241 Maltese children aged between 2;00-6;00, growing up in a bilingual community in Malta, where Maltese and English are the two official languages. Three groups of children were recruited: 1. children who used Maltese and English at home. 2. children who used Maltese only at home. 3. children who used English only at home. The results showed that the bilingual Maltese-English children outperformed monolingual-Maltese in terms of consonant accuracy; however, based on a retrospective comparison, monolingual-Maltese outperformed monolingual-English-speaking children (Dodd et al, 2003) with a higher PCC score of 8-10% up till the age of 5;05. Bilingual Maltese-English also outperformed monolingual-Maltese as well as monolingual-English (who both showed equal performance) in terms of a lower score of inconsistency of word production; however, the younger monolingual-English-speaking children (9%)(Dodd et. al, 2003) outperformed monolingual-Maltese (15%) with a lower score of inconsistency of word production, though both groups then reached comparable performance at the older age (4%). This pattern of findings might reflect a bilingualism effect upon the initial inconsistency of word production. However, once phonological knowledge in the two languages was more established, consistency of word production was promoted by having to differentiate the two languages. Bilingual Maltese-English outperformed monolingual-Maltese in terms of phone repertoire, with fewer missing phones by the age of 3;06-3;11. Both groups however completed the phone repertoire by 4;00, compared to monolingual-English speaking children only by 7;00 (Dodd et al., 2003). Bilingual Maltese-English used fewer simplification patterns after the age of 4;00 compared to monolingual-Maltese, though both groups shared many error patterns before 4;00. Bilinguals acquired phonology at a faster rate than monolinguals, with language-specific errors being suppressed earlier, while monolingual-English children exhibited error patterns that were all evident in the above two groups. Bilingual Maltese-English children were more likely to use either English or Maltese in naming pictures. Many monolingual-Maltese used some English words in the phonological picture-naming tasks. However, it was surprising to find that younger children used as many English words as older ones. The older children had more exposure to English through school and social activities. Grech & Dodd (2008) attributed this to early exposure to “motherese” containing some English words thought to be easier to pronounce than in Maltese, taught by speech-pathologists in Malta. Parents of monolingual-Maltese who had reported children’s only exposure in Maltese at home, and had observed the session, commented they had no clear idea on the actual number of English words the children have. However, it is not clear why the younger children in the normative study have to be seen by speech-language pathologists. The details of those English lessons were also not given. 52% of monolingual- Maltese were also found to name pictures in both Maltese and English even when they were not asked for, reflecting translation equivalents for some words in the tasks.

This bilingual cross-sectional study has opened up a new dimension in the field of bilingual phonological acquisition, in that it has challenged many past studies which have reported a delay of phonological acquisition due to an exposure to more than one language. The findings of this study are also supported by past studies reporting a bilingual and multilingual advantage for auditory discrimination since these children have to constantly make a choice of which language to use and to whom (Barnes, 2006), and past studies reporting a bilingual advantage for phonological awareness (Yavas & Core, 2001; Bialystok, Majumder & Martin, 2003). Phonological awareness is defined as an “ability to reflect on and manipulate the structure of an utterance as distinct from its meaning” (Stackhouse & Wells, 1997:53), for example: rhyming, blending, segmenting and manipulating syllables, clusters and phonemes are said to be phonological awareness tasks (Stackhouse & Wells, 1997). Insights from this study also suggest that it is unreliable to depend solely on parental reports of bilingual children’s language dominance in designing phonological studies in a bilingual community context. It is hard to distinguish L1 and L2 in children growing up in a bilingual community, therefore a clear socio-linguistic description is needed for this kind of study.

Unequal amount of input exposure and extent of use

It has long been observed that language input received from home or school contributes to speech development in children, and its absence may result in disordered speech (Shriberg & Kwiatkowski, 1982; see also cases of deprivation reported in Skuse, 1993 and Steinberg, Nagata & Aline, 2001). Input in a bilingual acquisition setting is much more heterogeneous than a monolingual acquisition setting. Language attrition and language loss as a result of decreased input amount and extent of use has long been observed, particularly in children growing up in a non-bilingual/multilingual community (e.g. Murrell, 1966; Cruz-Ferreira, 2006; De Houwer, 2009). The social status of a language being acquired by children growing up in a non-bilingual/multilingual community is also said to influence its acquisition and attrition (Li, 1994). Amount of input and extent of use is also observed to influence multilingual children’s phonological acquisition (Yang & Zhu, in press). It has been claimed that bilingual children receive quantitatively less input in each of their languages compared to monolinguals, which may have a negative effect on their phonological acquisition (So & Leung, 2006)(see section 2.1.2.3.2). De Houwer (2009) reviewed the literature and argued that the amount of language input or input frequency received by bilingual children is not necessarily less than monolingual children, as it all depends on the amount of time available for interaction (e.g. longer sleepers will have less opportunity for interaction than shorter sleepers), and the overall speaking rates of people interacting with the child (e.g. parents who have a higher average speaking rate would produce more words/hour, resulting in a higher input frequency received by child). De Houwer (2009) further distinguished between absolute frequency and relative frequency. The absolute frequency of global language

input for instance, is linked positively to both monolingual children (Hart & Risley, 1995), and bilingual children i.e. the more the caregivers talk, the more their bilingual child talks, in terms of total number of utterances (Allen, 2007). Nevertheless, with the bilingual child, it is also important to consider relative frequency i.e. the proportion of input of each language the child received. Research showed that the more Spanish words the bilingual Spanish-English children heard, the more Spanish words they produced compared to English (Pearson, Fernandez, Lewedeg & Oller, 1997). However, as this was based on parental estimates, one might argue over the reliability of the methodology used: it was not clear on what basis parents determine one language was used more often than the other, particularly in the context where both languages were used by so many people in the children's surrounding environment. In addition, the balance between children's input was fluid, so it might change from time to time (De Houwer, 2009). The unreliability of parental estimates of relative frequency of input or language dominance in the two languages has also been reported in studies of bilingual phonological acquisition (e.g. Goldstein et al., 2005; Grech & Dodd, 2008)(see Chapter 1). The present study provides statistical evidence supporting a rather similar proportion of exposure to the three languages being acquired by the multilingual children in a multilingual language context (see Chapter 1 & 6).

Language dominance

Language input is related to language dominance. Language dominance is determined by language input and extent of language use (Law & So, 2006; Yang & Zhu, in press); it is another key factor governing bilingual and multilingual phonological acquisition (Fantini, 1985; Paradis, 2001; Keshavarz & Ingram, 2002; Ball, Muller & Munro, 2001, 2006; Law & So, 2006). In a cross-sectional study of bilingual phonological acquisition by 100 simultaneous bilingual Cantonese-Putonghua children aged between 2;06-4;11, in two contiguous cities in Southern China (Hong Kong and Shenzhen), the effect of language dominance on phonological acquisition rate and pattern in both languages was investigated (Law & So, 2006). As predicted, language dominance plays a role in bilingual phonological acquisition, so the dominant group developed their phonology in each language faster than the non-dominant group. However, contrary to predictions, regardless of language dominance, Cantonese phonology developed faster than Putonghua phonology in all age groups. In other words, even the Putonghua non-dominant group also developed Cantonese phonology faster than Putonghua phonology, in terms of a higher percentage of phoneme correct (PPC). Law & So (2006) concluded that language dominance is not the sole factor governing bilingual phonological acquisition. This finding is also supported by a recent case study on multilingual phonological acquisition in Spanish-Mandarin-Hokkien (Yang & Zhu, in press)(see discussion on "linguistic factors" earlier in this section). The study by Law & So (2006) provides useful information on potential key factors underlying bilingual phonological acquisition. However,

there are issues about the methodology employed, particularly to that of determining language dominance. This was based on an adapted Western language background parental questionnaire. In addition, the adult input model was not considered in the data analysis. In reality, in a multilingual community like Shenzhen, children are exposed to Putonghua, Cantonese and other Chinese dialects in everyday life from birth (So & Leung, 2006- see another cross-sectional study in section 2.1.2.3.2), it is therefore hard to distinguish a definite L1 (most dominant language) & L2 (second dominant language). In addition, it is mentioned that, “onset of exposure”, alongside other variables such as age, gender, hearing status etc. were controlled in selecting bilingual children subjects in the study. However in Shenzhen for instance, as So & Leung (2006:424) claimed, it is quite common to have exposure to two languages from birth: “Their parents frequently have different mother tongues so that children can be exposed to two languages from birth (most fathers spoke Cantonese while mothers spoke Putonghua)”. This suggests that it is not easy to control for “onset of exposure” in these bilingual populations. Lim et al. (2008) discussed the practical difficulty of determining language dominance in Asian countries like China, Taiwan, Malaysia and Singapore where the distinction between L1 and L2 is normally fuzzy, owing to the complex sociolinguistic background. Moreover according to Lim et al. (2008), language dominance-determining predictors such as age of first exposure, age of arrival and length of residence in L2 speaking-country are not appropriate predictors of dominance for early bilinguals and multilinguals in Asian countries, since children in these countries are normally exposed to various languages before the age of five. Further, Cantonese variants were taken into consideration when scoring children’s production whereas Putonghua variants were not (see Law & So, 2006). It is possible that this imbalance in considering adult input in data analysis might have resulted in a better score in Cantonese than Putonghua.

Input model

Another important factor which has also to do with input is the input model or language model in bilingual and multilingual phonological acquisition. Though Genesee (1989, 2000b) has pointed out the importance of studying adult input in bilingual acquisition to explain features of language production in bilingual children, to-date, very few bilingual studies have included adult input models in the data analysis (see section 2.1.1 & De Houwer, 2009 for a review). Watson (1991) reported influences of variable productions in both monolingual and bilingual adults on the productions of their children. Deuchar & Clark (1995) analysed voice onset time in a bilingual child, and reported influences of the native English mother’s Spanish accent on the bilingual child’s use of voicing lag, instead of voicing lead, for voiced stops in Spanish. Whitworth (2002) compared parental speech rhythm with bilingual German-English children’s speech rhythm production in three families, and reported a close relationship between parent and child speech rhythm patterns. It is important to study local influences from adults in the bilingual children’s immediate linguistic environments (Genesee,

1989, 2000b) since even young children are observed to approximate adult input forms in their first word acquisition (Vihman, 2002; 2007). Drawing on insights from sociolinguistic studies of monolingual acquisition that dialectal, individual and stylistic variability are acquired by children from the adult at an early age (Docherty & Foulkes, 2000; Scobbie, 2005), Khattab (2002, 2006) addressed these sociophonetic variations in her study of /l/ production in bilingual Arabic-English children growing up in Yorkshire, England. Data from the bilingual children's friends and from parents of both monolingual and bilingual children were included in the analysis. The bilingual children exhibited fewer than expected initial dark /l/ pattern in English, which can be traced back to their non-native adult input. They have also exhibited a wider set of /r/ sounds to that of monolingual, owing to the complex interaction between Arabic, English and non-native English varieties that they are exposed to. This finding highlights the importance of considering the input model, without which misinterpretation of developmental patterns might have happened (Khattab, 2006). As bilingual children are exposed to standard, non-standard, and non-native varieties which often result in fuzzy boundaries for a given target, it is therefore proposed that sociolinguistic variants should be factored in as part of the methodological procedure in studies of bilingual acquisition (Khattab, 2006). This methodology is particularly useful when studying children growing up in bilingual or multilingual communities, in which language in contact has given rise to new local language varieties such as Singaporean English (Singlish) (De Houwer, 2009) and Malaysian English (Manglish)- the local language variety under study in the present investigation (see Chapter 3).

The review so far indicates that changes in input pattern may result in language attrition and even loss especially in children growing up in a non-bilingual/multilingual community. Input predicts language dominance, which plays a part in bilingual and multilingual phonological acquisition, though it is not the sole contributing factor. However, determining language dominance, particularly in the multilingual setting of Asia is a difficult task, and it has sometimes resulted in methodological constraints in bilingual and multilingual phonological acquisition studies. In addition to input quantity that the children receive, it is also important to consider the input quality that they are exposed to, namely the language model (phonological features) in the phonological analysis since it has methodological implications for how the data are analysed (Lanza, 1998), specifically in order to avoid misinterpretation of potential local phonological variants as developmental error patterns in children growing up in a bilingual or multilingual community.

Cross-linguistic influences

Cross-linguistic interaction in bilingual and multilingual phonological acquisition may take several forms namely: language-specific features used in the wrong language, shared features used in the wrong phonotactic position, and error patterns atypical to monolingual children of the same age (Yang & Zhu, in press)(c.f. Holm & Dodd, 2006). Paradis & Genesee (1996) proposed a Dual Hypothesis Model in lieu of the Unitary Model or Fusion Hypothesis Model to account for bilingual French/English syntactic interaction. They distinguish interdependent development from autonomous development (see section 2.1.1), and identify three broad types of interdependence: delay, acceleration and transfer. In general, delay occurs when a feature in one language is acquired later than expected due to the influence of the other language. Conversely, acceleration occurs when a shared feature (normally the early acquired one) in one language is acquired earlier than expected due to influence of the other language. On the other hand, transfer occurs when a feature in one language shows up in the other language, usually the dominant language shows up in the weaker one, resulting in a deviant pattern. The language development of the bilingual child does not necessarily conform fully to either inter-dependent or autonomous pattern, some language aspects may develop inter-dependently, other aspects may develop autonomously. Moreover, interdependence may be a product of specific language combinations, but not other language combinations.

Specific language combinations may give rise to specific cross-linguistic effects (Genesee, 1993)(see section 2.1.1) because of different language characteristics in each of the ambient languages and the interaction between the two phonological systems, thus it is important to investigate different language combinations (Zhu & Dodd, 2006b). Law & So (2006) found no interference between the two tonal languages in their bilingual Cantonese-Putonghua children and attributed the non-interference between the two languages to close language relatedness factor i.e. both are Chinese languages, though this finding is inconsistent with several other phonological acquisition studies in bilingual and multilingual Chinese children (Dodd et al., 1996; Holm & Dodd, 1999b, 2006; So & Leung, 2006; Yang & Zhu, in press)(see section 2.1.2.3.1 & 2.1.2.3.2). The majority of research so far has concerned languages from similar language families, though recent years have seen an emerging interest in typologically different languages (e.g. Zhu & Dodd, 2006a, Yang & Zhu, 2009).

2.2 PHONOLOGICAL DEVELOPMENT IN MONOLINGUAL CHILDREN

In this section, monolingual phonological acquisition, which in the preceding section served as useful baseline for discussion of bilingual and multilingual phonological acquisition, will be described. These studies, which concern fundamental processes of language acquisition such as rate, patterns and strategies of acquisition, are relevant to the present study because of their shared features. More specifically, they are the studies on acquisition of all core phonological aspects i.e. consonant, vowel, syllable structure, consistency of word production and tone (for Mandarin), particularly those using similar methodologies and analytical tools such as: cross-sectional study approach, similar pre-school age-range, picture-naming task, phonological processes analysis of error patterns or strategies of phonological acquisition, and those involved ethnic Chinese children. The strengths and shortcomings of the methodologies used in these studies which might affect the conclusion of the research findings will also be discussed.

2.2.1 Phonological development in English-speaking children

Phonological development in English is by far the most thoroughly described (e.g. Wellman, Case, Mengert & Bradbury, 1931; Poole, 1934; Templin, 1957; Sander, 1972; Prather et al., 1975; Smit et al., 1990; Dodd et al., 2003). Studies on other languages such as German, Mandarin and Cantonese have often used the developmental patterns found for English as the baseline for comparison and discussion (Zhu & Dodd, 2006b).

Singleton consonants

Several large-scale cross-sectional normative studies on consonantal acquisition have been carried out since the 1930s (Creaghead, Newman & Secord, 1989). Amongst others, the studies conducted by Wellman et al. (1931), Poole (1934), Templin (1957), Sander (1972) and Prather et al. (1975) have been the most frequently cited (Shipley & McAfee, 1998). Typically, in these studies, consonant production was tested via naming pictures or objects, answering questions and repeating words. Picture-naming tasks comprised familiar words containing most if not all the target consonants in English. The tester encouraged spontaneous naming in the child, in the absence of which cues such as forced-alternative choices (e.g. "Is it a dog, chicken or snake?") or direct imitations (e.g. "Say chicken.") would be given. The general sequence of mastery of consonants was then derived from a predetermined minimum percentage of children in an age group achieving a certain degree of production accuracy (Creaghead et al., 1989; Shipley & McAfee, 1998; Dodd et al., 2003). These studies have provided useful norms on acquisition of consonants in pre-school children across a wide range of age groups (Creaghead et al., 1989). Table 2.2 summarises the findings of these

classical studies of English consonant acquisition (see also Dodd et al., 2003 for a review):

Table 2.2: Age of consonant acquisition based on five classical studies

Cons.	Wellman et al. (1931)	Poole (1934)	Templin (1957)	Sander (1972)	Prather et al. (1975)
m	3;00	3;06	3;00	Before 2;00	2;00
n	3;00	4;06	3;00	Before 2;00	2;00
h	3;00	3;06	3;00	Before 2;00	2;00
p	4;00	3;06	3;00	Before 2;00	2;00
f	3;00	5;06	3;00	3;00	2;00-4;00
w	3;00	3;06	3;00	Before 2;00	2;00-8;00
b	3;00	3;06	4;00	Before 2;00	2;00-8;00
ŋ	>6;00	4;06	3;00	2;00	2;00
j	4;00	4;06	3;06	3;00	2;00-4;00
k	4;00	4;06	4;00	2;00	2;00-4;00
g	4;00	4;06	4;00	2;00	2;00-4;00
l	4;00	6;06	6;00	3;00	3;00-4;00
d	5;00	4;06	4;00	2;00	2;00-4;00
t	5;00	4;06	6;00	2;00	2;00-8;00
s	5;00	7;06	4;06	3;00	3;00
r	5;00	7;06	4;00	3;00	3;00-4;00
tʃ	5;00		4;06	4;00	3;00-8;00
v	5;00	6;06	6;00	4;00	4;00
z	5;00	7;06	7;00	4;00	4;00
ʒ	6;00	6;06	7;00	6;00	4;00
θ		7;06	6;00	5;00	4;00
dʒ			7;00	4;00	4;00
ʃ		6;06	4;06	4;00	3;00-8;00
ð		6;06	7;00	5;00	4;00

Source: adapted from Creaghead et al. (1989:47) & Dodd et al. (2003:28-9).

Cons.: consonant.

Table 2.2 shows that the later studies generally exhibited earlier consonant development than the earlier ones (Shipley & McAfee, 1998). Nevertheless, these studies generally agreed that stops, nasals and glides were acquired before fricatives, affricates and consonant clusters (see further discussion on “consonant clusters” later in this section), and the developmental profile was completed by around the age of 7;00. This finding was further supported by later studies (e.g.

Irwin & Wong, 1983; Stoel-Gammon & Dunn, 1985; Grunwell, 1987; Smit al., 1990; Dodd et al., 2003). The similarities and differences of the findings in these studies partly reflect the different methodologies and procedures employed, namely: sample size, age ranges, stimuli, target consonants, elicitation techniques and consonantal mastery criteria (Creaghead et al., 1989; Vihman, 1998; Shipley & McAfee, 1998).

In addition to age of acquisition, the developmental error patterns exhibited by the children were identified in several studies (e.g. Weiner, 1979; Shriberg & Kwiatkowski, 1980; Ingram, 1981; Grunwell, 1987; Bleile, 1995; Vihman, 1998; Dodd et al., 2003). The most common phonological errors are summarised in Table 2.3:

Table 2.3: Consonant errors in English

Error pattern	Description	Example
Syllable deletion	Deletion of an unstressed or even stressed syllable.	pədjamas → djamas
Final consonant deletion	Deletion of a syllable-final consonant.	dog → do
Reduplication	Repetition of a syllable (incomplete or complete).	slipiŋ → slipliŋ
Consonant harmony	One segment influences another so that the two become more alike.	jəlo → lelo
Cluster reduction	Deletion of a consonant cluster.	sta → ta
Stopping	Replacement of a fricative or an affricate by a stop.	lafiŋ → lapin watʃ → wat
Velar fronting	Replacement of a velar by an alveolar.	klok → klot
Post-alveolar fronting	Replacement of a post-alveolar by an alveolar.	fiʃ → fis
Deaffrication	Replacement of an affricate by a fricative.	watʃ → waʃ
Gliding	Replacement of a liquid by a glide.	tʃi → twi
Voicing	Pre-vocalic voicing and post-vocalic devoicing.	*paɪ → baɪ ɹed → ɹet

Source: compiled from: Grunwell (1987), Bleile (1995), Vihman (1998) and Dodd et al. (2003).

**All examples are taken from the present data except for pre-vocalic voicing.*

These error patterns decrease mostly between 2;00 and 4;06 (Grunwell, 1987). Despite variations in age of suppression of error patterns reported in the above studies, these error patterns can be classified under two broad categories namely: those that disappear by around 3;00 and those that still persist after 3;00 (see Table 2.4):

Table 2.4: Age of suppression for consonant errors in English

Suppressed by around 3;00	Persist after 3;00
Syllable deletion	Cluster reduction
Final consonant deletion	Stopping
Reduplication	Post-alveolar fronting
Consonant harmony	Deaffrication
Velar fronting	Gliding
Voicing	Devoicing

Source: compiled from Stoel-Gammon & Dunn (1985), Grunwell (1987), Bleile (1995), Shipley & McAfee (1998) and Dodd et al. (2003).

These cross-sectional studies have provided a useful overview of the normal developmental pathway of pre-school children (Vihman, 1998). However, they have all used different methodologies and procedures (i.e. sample size, age ranges, stimuli, target consonants, elicitation techniques and consonantal mastery criteria) which might affect the conclusion on age of acquisition of segments (Vihman, 1998; Shipley & McAfee, 1998; Dodd et al., 2003). Zhu (2006a) describes the varied paradigms employed by these researchers which have complicated direct comparison of findings across phonological acquisition and disorders research, within and across languages. Among other issues detailed in Zhu (2006a), the important mastery criteria for consonant production for instance, were varied across these studies (Zhu, 2006a). These criteria should be taken into account and agreed upon by researchers in order to facilitate comparative analysis across languages (Zhu, 2006a).

1. Acquisition of sounds: Researchers have used various paradigms: a. phonetic vs. phonemic acquisition. The former refers to the ability to articulate a sound in a word context or in isolation; whereas the latter refers to the ability to use a sound correctly in most production opportunities (e.g. Fox, 2000). b. phoneme emergence vs. phoneme stabilisation. The former refers to the ability to produce a sound in a word context (but not in isolation) irrespective of whether it matches the target. It is sometimes described as “the first appearance of the sound” (Topbas & Yavas, 2006:248); whereas the latter refers to the ability to produce a sound correctly on at least two out of three opportunities (Zhu & Dodd, 2000).
2. Acquisition of sounds in relation to word position: Some researchers considered a sound to be acquired only when it is produced correctly in all three word positions namely: initial, medial and final (e.g. Wellman et al., 1931; Poole, 1934; Templin, 1957). Others adopted a less stringent criterion i.e. only two word positions namely: initial and final or at least two out of three positions (e.g. Prather et al., 1975; Smit et al., 1990; Sander, 1972).

3. Group acquisition of sounds: Some researchers used 75% as an arbitrary criterion for the minimum percentage of children in an age group required for it to be considered that a sound was being produced correctly (e.g. Wellman, 1931; Templin, 1957; Prather et al., 1975). Others adopted a 90% criterion (e.g. Dodd et al., 2003) or, a 100% criterion (e.g. Poole, 1934). The higher percentage (i.e. 90%) was used to exclude the potential 10% incidence of speech disorder in a given population (Enderby & Phillipp, 1986).

Consonant clusters

Consonant clusters were included in the cross-sectional studies described above. Some longitudinal studies of consonant cluster acquisition have also been undertaken (e.g. Dyson & Paden, 1983; Watson & Scukanec, 1997)(see also the review in Barlow, 2001). However, there are not many studies focusing exclusively on consonant cluster acquisition, except for McLeod, Doorn & Reed (2001). Table 2.5 summarises the findings of consonant cluster acquisition based on three studies:

Table 2.5: Age of consonant cluster acquisition based on three studies

Clusters	*Templin (1957)	*Smit et al. (1990)	**McLeod et al. (2001)
tw	4;00	3;06f, 3;06m	-
kw	4;00	3;06f, 3;06m	2;06
sp	4;00 ^r	4;06f, 5;00m ^r	2;06
st	4;00	4;06f, 5;00m ^r	2;06
sk	4;00 ^r	4;06f, 6;00m	3;00
sm	4;00 ^r	5;06f, 7;00m	2;06
sn	4;00 ^r	5;06f, 5;00m ^r	2;06
sw	7;00	4;06f ^r , 6;00m	2;06
sl	7;00	6;00f, 7;00m	2;06
pl	4;00 ^r	4;00f, 5;06m	2;06
bl	4;00	4;00f, 5;00m	2;06
kl	4;00	4;00f, 5;06m	2;06
gl	4;00	4;06f, 4;06m	2;06
fl	5;00	4;06f, 5;06m	2;06
pɹ	4;00 ^r	6;00f, 5;06m	-
bɹ	4;00 ^r	6;00f, 6;00m	2;06
tɹ	4;00	6;00f, 5;06m	2;06
dɹ	4;00	6;00f, 5;00m ^r	2;06
kɹ	4;00 ^r	4;06f ^r , 5;06m	2;06
gɹ	4;06	6;00f, 5;06m	2;06
fɹ	4;06	6;00f, 5;06m	2;06
θɹ	7;00	7;00f, 7;00m	-
skw	6;00	4;06f ^r , 7;00m	2;06
spl	7;00	6;00f, 7;00m	-
spɹ	7;00	8;00f, 8;00m	-
stɹ	5;00	8;00f, 8;00m	3;00
skɹ	7;00	8;00f, 8;00m	-
-ks	-	-	2;06
-mp	-	-	2;06
-nt	-	-	2;06
-nd	-	-	2;06
-nʃ	-	-	2;06
-ntʃ	-	-	2;06
-ndʒ	-	-	2;06
-ŋk	-	-	2;06
-ft	-	-	3;00
-st	-	-	2;06

*Source: both adapted from Smit et al. (1991:789)

**Source: compiled from McLeod et al. (2001:1170-1).

f: female, m: male.

^r: a reversal occurs in older age groups.

Table 2.5 shows that the latest study by McLeod et al. (2001) indicates an earlier acquisition of consonant clusters than the two earlier studies. As with singleton consonants, the discrepancy in the findings might be a result of methodological differences. The results of Templin (1957) and Smit et al. (1990) were based on a large-scale cross-sectional study approach in which speech samples were collected via elicitation, whereas McLeod et al. (2001) carried out a longitudinal study in which spontaneous speech samples from sixteen two-year-old children were compiled. In accordance with these methodological differences, the mastery criteria for consonant cluster production and the age ranges studied were also different.

Templin (1957) and Smit et al. (1990) reported that consonant clusters containing stops (e.g. /pɫ, kɹ, tʷ/) were acquired before consonant clusters containing fricatives (e.g. /sw, fl, θɹ/). These findings were not supported by McLeod et al. (2001): four of their youngest children (aged between 2;01-2;06) exhibited correct production of consonant clusters containing fricatives (e.g. [sp, st, sm, sn]). On the other hand, all three studies agreed that two-element CC- clusters (e.g. /st/) were acquired before three-element CCC-clusters (e.g. /stɹ/). The earliest consonant clusters appearing in the two to three year olds' repertoire were consonant clusters containing [w] (e.g. [pw, bw, dw, kw, gw, fw]), where [w] is used as a phonetic realization of the phonemic target /r/, only /tw/ and /kw/ are found in the adult phonological system (see Table 2.5), The most common final consonant clusters were those containing a nasal (e.g. [-nd,-nt, -ŋk]) (Watson & Scukanec, 1997; McLeod et al., 2001). Initial consonant clusters were observed to appear in the children's repertoire before the final consonant clusters (McLeod, 2001 et al.). This findings was not consistent with the previous studies (e.g. Watson & Scukanec, 1997) in which final consonant clusters were found to appear before initial consonant clusters.

According to McLeod et al. (2001), the development of consonant clusters is gradual. There is a general increase in consonant cluster production accuracy with simultaneously a general decrease in errors. The developmental error patterns of consonant clusters were observed to evolve from "consonant cluster reduction" where one element was deleted to, "consonant cluster simplification" where one element was simplified, commonly through assimilation, epenthesis and metathesis, and finally towards the route of correct consonant cluster production (e.g. STAR→[sɑ→tas→stɑ])(Dyson & Paden, 1983; Watson & Scukanec, 1997; McLeod et al., 2001).

Vowels

In general, the development of vowels has received less attention than consonants. Some of the above cross-sectional studies for instance have excluded vowel acquisition (e.g. Smit et al., 1991). This might be due to the fact that vowels are acquired fairly early i.e. approximately by 2;00, and vowel errors are rare after 3;00 (Smit et al., 1990; Stokes & Wong, 2002; Donegan, 2002). Consonants are claimed to be more prone to error than vowels (Dodd, 1995a). Thus far, very little is known about the errors of vowels (Reynolds, 1990).

It is important to study vowel development as the production of vowels influences the production of consonants, and the interaction of consonants and vowels is a developmental feature in early phonological acquisition (Stokes & Wong, 2002). Children with phonological disorders for instance are vulnerable to vowel errors (Pollock & Keiser, 1990; Stoel-Gammon & Herrington, 1990). Selby, Robb & Gilbert (2000:256) cited three stages of vowel (monophthong) production development from Stoel-Gammon & Herrington (1990)(see Table 2.6):

Table 2.6: The three stages of vowel acquisition based on Stoel-Gammon & Herrington (1990)

Stage	Vowel	Description
Stage 1	i, u, o, α, Λ	Early acquisition of the three corner vowels: i, u, α. Primarily tense vowels except: Λ.
Stage 2	æ, ʊ, ɔ, ə	Completion of the four corner vowels and back vowels.
Stage 3	ɪ, e, ε, ɜ, ø	Late acquisition of the front vowels and rhotic vowels.

Source: compiled from Selby et al. (2000:256).

In a longitudinal study conducted by Selby et al. (2000), the vowel development of four children was examined periodically at 15 months, 18 months, 21 months, 24 months and 36 months. Table 2.7 summarises their findings:

Table 2.7: Age of vowel acquisition based on Selby et al. (2000)

Age (months)	Vowel	Size
15	α, ɪ, ʊ, Λ	4
18	α, i, u, ʊ, Λ, ɔ, æ	7
21	α, i, ɪ, ε, u, o, Λ, ɔ	8
24	α, i, ɪ, ε, e, u, o, ɔ, æ	9
36	α, i, ɪ, ε, e, u, ʊ, o, Λ, ɔ, æ, ɜ	12

Source: Selby et al. (2000:260).

Selby et al. (2000) reported that at 15 months, lax vowels /ɪ, ʊ, ʌ/ were predominant in the earliest stage of acquisition, whilst by 18 months, tense vowels and corner vowels /i, u, ɑ, æ/ had appeared. By 21 months, the size of vowels increased two fold i.e. from four to eight. By 24 months, all eight cardinal vowels were mastered /ɑ, i, ε, e, u, o, ɔ, æ/. By 36 months, the children's inventory for English vowels was nearly complete. The main differences between Selby et al.'s (2000) findings and Stoel-Gammon & Herrington (1990) were the early acquisition of lax vowels (not tense vowels) and front vowels (not back vowels). However, Selby et al. (2000) claimed that their findings lent some support to those of Kent & Bauer (1985). Stokes & Wong (2002) in their review of vowel acquisition across various languages concluded that central low vowel /a/, high front vowel /i/ and high back vowel (usually /u/) emerged first, followed by a tense/lax distinction, and a round contrast.

Vowels in the second syllable of English disyllabic words are said to be vulnerable to errors (Paschall, 1983). The most common vowel errors are: 1. substitution of vowel [ə] for most other vowels. 2. substitution of other vowels which are close to the target vowel space but are more lowered and fronted (Dodd, 1995a; Dodd, Holm, Crosbie & Zhu, 2005). Other English vowel developmental patterns which have been identified (Donegan, 2002) are for instance: 1. substitution which involves lowering (e.g. /ʊ/→[ɔ], /ɪ/→[ε]) 2. substitution which involves raising (e.g. /e/→[i]). 3. addition (e.g. /æ/→[ai]). 4. reduction (e.g. /ei/→[e]).

Stokes & Wong (2002) review the literature on English diphthong development and commented that this area is under-explored, with only four diphthongs being investigated. Wellman et al. (1931) studied the vowel and diphthong development in 204 children aged between 2;00 and 6;00. They reported that children acquired the diphthongs /ai, ɔi, au/ by 3;00. Although only three diphthongs were mentioned, the results of their study showed that some diphthongs were acquired before vowels in English. Paschall (1983) reported that four English diphthongs: /au, ɔi, ai, iu/ were acquired by twenty children aged 16 to 18 months, with a production accuracy ranging from 40%-62%. These four diphthongs were acquired by children aged 21 to 24 months old with a higher production accuracy i.e. over 97% (Hare, 1983). Dodd (1995a) reported that most English vowels were acquired by the age of 20 months by five children in her longitudinal study, except for the following monophthongs and diphthongs: /ʊ, ε, ɪə, eɪ, ɔɪ/. The following vowel errors were evident in her five children aged between 20-36 months: 1. substitution of neutral unrounded vowels [ʌ, ə] (e.g. DRESS→[dʌ], MILK→[mɛk])(30.9% of all vowel errors). 2. lengthening and/or rounding of vowels before final consonant deletion (e.g. BELL→[bou],

BELT→[beə])(26.4%). 3. vowel harmony (e.g. RUNNING→[wʌnʌ])(4.6%). By 30 months, no vowel errors were observed in the five children. The review so far suggests that there is a significant improvement in the acquisition of diphthongs by 2;00 (Stokes & Wong, 2002).

Syllable structures

Thus far, most studies on syllable structures have been longitudinal studies focusing on the development of syllable structures alongside other phonological components such as consonants and vowels in a young child. In the above cross-sectional studies on phonological development, more attention has been paid to consonant acquisition than vowels, and even less to syllable structure or phonotactic acquisition.

Stoel-Gammon (1987) described the syllable structures used by thirty-three two-year old children in her cross-sectional study. Most of her children produced the following syllable structures: CV, CVC monosyllable structures and CV-CV, CV-CVC disyllable structures. James (2001) claimed that the number of syllables and syllable structure complexity influence production of vowels and consonants. Hence it is useful to include words with different syllable structure and length in a test of phonological development.

Consistency of word production

Thus far, most studies have not examined the inconsistency of word production which is often associated with phonological “regressions” or “reversals” (Wellman et al, 1931; Bleile & Tomblin, 1991; Bleile, 1995 & 1996; Dodd, 1995a) namely: “temporary losses of articulation and phonological abilities” (Bleile, 1995:146). Smit et al. (1990) in their large-scale cross-sectional study included an intra-word consistency of production sub-test in their phonological test, whereby a large proportion of their children were asked to repeat five to seven of the phonological test items at the end of the test. Unfortunately they did not present the findings of this sub-test in their report. Two types of inconsistency of word production have been identified namely: intra-word inconsistency of production and inter-word inconsistency of production (Ingram, 1979). For intra-word inconsistency of production, a child might pronounce a target segment in a given word in various ways (e.g. CLOCK→[klok, kloʔ, kɔʔ]). Sosa & Stoel-Gammon (2006) claimed that the intra-word inconsistency peaks at the stage of acquisition of 150-200 words, coinciding with the onset of combinatorial speech. Whilst slight inconsistency of word production is common during the course of phonological acquisition, pervasive inconsistency of word production may indicate a deficit in speech-processing abilities (Grunwell, 1981; Williams & Stackhouse, 2000). Inter-word inconsistency of production may arise

because the child replaces a target segment which has previously been acquired with various segments across different words (e.g. /t/→[t, k, g] in TABLE→[tebə], TEETH→[ki], TEA→[gi]). One of the sources for this regression is the “word-based learning” strategy adopted by young children (Bleile, 1995, 1996). During the course of phonological acquisition however, this word-based learning will resolve and be replaced by rule-based learning. Whilst word-based learning is common in young children, persistent usage of this strategy may cause pervasive variability and unintelligibility in speech (Bleile, 1995, 1996; Forrest, Elbert & Dinnsen, 2000).

Holm, Crosbie & Dodd (2007) established normative data on word production consistency in typically developing children. A total of 409 British children aged between 3;00-6;11 were recruited in the study. The children were assessed using the Inconsistency Assessment (Dodd, 1995a), in which they had to name 25 test pictures on three separate occasions within a session. The test consists of one to four syllables, and most of the consonants and vowels in English (see Chapter 5). The study aimed to differentiate normal speech variability from highly inconsistent speech, as the later is considered as a clinical indicator for speech disorder. Holm et al. (2007) concluded that the majority of the children showed consistently correct responses. The youngest three-year-old children exhibited more consistently incorrect productions than consistently correct productions, compared with the older children. With age, children improved significantly on their consistency of word production, and children made more consistently correct than consistently incorrect productions. By 4;06, children showed highly consistent word production. This finding of age effects on word production consistency was consistent with previous studies by Teitzel & Ozanne (1999), Williams & Stackhouse (2000) and Dodd et al. (2003)(see Dodd et al., 2005 for a review).

2.2.2 Phonological development in Chinese-speaking children

There has been an upsurge in research into phonological acquisition in Chinese-speaking children since the 1970s. Most studies of monolingual phonological development in Chinese-speaking children have taken place in mainland China and Taiwan. The varieties of language under study include: Mandarin/Putonghua (in China and Taiwan) and Cantonese (in Hong Kong, Southern China). There are fewer studies of phonological acquisition in Chinese-speaking children than those of English-speaking children. In the following section, phonological acquisition in both Mandarin and Cantonese will be described.

Phonological development in Mandarin (Putonghua)

With the exception of Zhu & Dodd (2000), thus far most studies on phonological acquisition in Mandarin were diary records of a small number of pre-school children (e.g. Chao 1951/73; Li & Thompson, 1977; Jeng, 1979; Su, 1985; Hsu, 1987; Shiu, 1990)(see Zhu, 2002 for a review). These pioneer studies described acquisition of consonants, vowels and tones in Chinese pre-school children. However, these studies have methodological problems: the acquisition of phoneme criteria are not clear (e.g. Jeng, 1979; Hsu, 1987), the chronology of error patterns is also not clear, and the sample size is small (Zhu, 2002).

The cross-sectional study of 129 (68 boys and 61 girls) Chinese pre-school children in Beijing conducted by Zhu & Dodd (2000) was the first large-scale research on phonological acquisition in Putonghua. In this study, the consonants, vowels and tones in Putonghua were examined. Two main phoneme acquisition criteria were adopted (Zhu & Dodd, 2000:16-7): 1. age of emergence: “a phoneme was considered to have emerged when 90% of the children in an age group produced the sound at least once, irrespective of whether it was the correct target”. 2. age of phone stabilization: “a sound was considered stable when the child produced the sound correctly on at least two out of three opportunities. When 90% of the children in an age group achieved an accuracy rating of at least 66.7% for a phoneme, the phoneme would be considered to have been stabilized by that age group”. However, an additional criterion of 75% for both age of emergence and age of stabilization was also used in order to facilitate comparison of findings with past studies in English and other languages. Both picture-naming and picture-description tasks were used. The picture-naming test comprised forty four words familiar to children whilst the picture-description tests incorporated words from the picture-naming test. The children were asked to name the pictures in the picture-naming test spontaneously, failing which some semantic cues, contextual prompts and direct imitation would be given. Imitated productions were considered when age of emergence was calculated, but excluded when age of stabilization was calculated. This is because the former concerns articulation ability whilst the later concerns articulation accuracy. Tables 2.8 & 2.9 summarise Zhu & Dodd’s (2000) findings on order of consonant acquisition in Putonghua.

Table 2.8: Age of emergence for consonants in Putonghua

Age	90% criterion	75% criterion
1;06-2;00	t, t ^h , k, m, n, ŋ, x, tʃ, tʃ ^h , ʃ	t, t ^h , k, m, n, ŋ, f, s, x, tʃ, tʃ ^h , ʃ, p ^h , p
2;01-2;06	f, s, tʃ	s, tʃ, tʃ ^h , k ^h
2;07-3;00	p, l	ts, l
3;01-3;06	p ^h , k ^h , tʃ ^h	ɹ, ts ^h
3;07-4;00	ʃ	
4;01-4;06	ts, ts ^h , ɹ	

Source: Zhu (2006b:92).

Table 2.9: Age of stabilisation for consonants in Putonghua

Age	90% criterion	75% criterion
1;06-2;00	t, m, ŋ	t, t ^h , m, n, ŋ, x
2;01-2;06	n	p, p ^h , k, k ^h , ʃ, tʃ, tʃ ^h
2;07-3;00	p, t ^h , f, x, ʃ	f
3;01-3;06	k, k ^h	
3;07-4;00	p ^h	
4;01-4;06	l, s, ɹ, tʃ, tʃ ^h	l, s, ʃ, ɹ
>4;06	ʃ, tʃ, tʃ ^h , ts, ts ^h	tʃ, tʃ ^h , ts, ts ^h

Source: Zhu (2006b:92).

Zhu & Dodd (2000) concluded that some of the sounds became stabilized very quickly (e.g. /t, m, p/) whilst others took a longer time (e.g. /tʃ, tʃ^h, s/). The consonants containing the features of aspiration, affrication and retroflexion were acquired last. Further, there were no significant differences between production accuracy on the picture-naming task and on the picture-description task. The children were consistent on production of vowels and consonants across the single word picture-naming task and connected speech picture-description task. Fifteen error patterns were identified and classified under three main categories namely: assimilation, deletion, and systemic substitution (see Table 2.10). These error patterns were used by more than 10% of children in the youngest age group.

Table 2.10: Chronology of phonological errors in Putonghua

Error patterns	Age					
	1;06-2;00	2;01-2;06	2;07-3;00	3;01-3;06	3;07-4;00	4;01-4;06
Consonant assimilation	-----					
Syllable initial deletion	-----					
Syllable-initial*	-----					
Fronting: $\text{ʃ} \rightarrow \text{s}$	-----					
$\text{ɸ} \rightarrow \text{ʃ}/\text{s}$	-----					
$\text{k} \rightarrow \text{t}$	-----					
Backing: $\text{s} \rightarrow \text{ʃ}$	-----					
Stopping: $\text{ts} \rightarrow \text{t}$	-----					
$\text{s} \rightarrow \text{t}$	-----					
$\text{x} \rightarrow \text{k}$	-----					
Affrication: $\text{ɸ} \rightarrow \text{tɸ}$	-----					
Deaspiration: $\text{t}^{\text{h}} \rightarrow \text{t}$	-----					
Aspiration: $\text{t} \rightarrow \text{t}^{\text{h}}$	-----					
x-velarisation	-----					
Gliding	-----					
Syllable-final	-----					
Final n deletion	-----					
Backing: $\text{n} \rightarrow \text{ŋ}$	-----					
Final ŋ deletion	-----					
Vowels	-----					
Triphthong reduction	-----					
Diphthong reduction	-----					

Source: Zhu (2006b:94).

*Typical examples are given next to error patterns.

- - - Indicates that 10-20% of the children of an age group used an error pattern.

----- Indicates that more than 20% of the children of an age group used an error pattern.

Zhu & Dodd (2000) claimed that both systemic and structural simplifications were present in their data. They compared their findings with other languages such as English and noted some cross-linguistic similarities and differences. The English-speaking children also exhibited both systemic and structural simplifications. However, whilst velar fronting was common in English, it was less common in Putonghua. Instead, retroflex fronting was more common in Putonghua. In addition, backing which was an atypical simplification in English was very common in Putonghua.

Vowels were generally acquired before consonants. The major vowel error patterns were triphthong reduction and diphthong reduction. The replacement of a triphthong by a diphthong was more common than by a monophthong, and the middle vowel of the target was often retained (e.g. /iao/→[ia]). When a diphthong was replaced by a monophthong, the element retained was often the one which is more sonorant: the second element of the ongliding diphthong (e.g. /ua/→[a]) or the first element of the offgliding diphthong (e.g. /ao/→[a]). In another longitudinal study by Zhu (2002) on four young children between around 1;00 and 2;00, /ei/ was reported to be the first acquired diphthong whilst /yε/ was the last. For triphthongs, /iou/ was the first whilst /uae/ was the last.

Tones were acquired before consonants and vowels. There were only two tonal errors in the entire corpus of data. These two tonal errors were: 1. T2→T4, and 2. T3→T2. Though five children were observed to occasionally use the citation tones for target tone sandhi, this finding was inconclusive owing to the fact that tone sandhi was tested in a single-word text in the study (Zhu & Dodd, 2000). The neutral tone (in weakly-stressed syllables) was observed to have emerged in around 50% of the children in the youngest age group, and mastered by 36% of the children in the oldest age group. The most common error pattern for the affix-related neutral tone was deletion (see Chapter 3).

In her longitudinal study of vowel development mentioned above, Zhu (2002) also analysed the tonal acquisition of four children. She reported that tones were mastered by 1;10. In terms of the order of acquisition of tones, the high level and high falling tones were found to be the first emerging tones (1;02), followed by rising tones (around 1;04), and falling-rising tones (1;04-1;07). However, the high level tones were found to be stabilized first (1;06), followed by the high falling tone (1;07), the rising tones and the falling-rising tones (1;10). The most common error patterns were substitutions (see Table 2.11):

Table 2.11: Error patterns of Putonghua tones

Target tones	The most frequent substitute(s)
High level	High falling
Rising	High level
Falling-rising	High level/rising
High falling	High level

Source: Zhu (2006b:88).

Zhu & Dodd (2000) explained their data in terms of phonological saliency. Phonological saliency has been alluded to by others (Peter, 1983; Vihman 1996), though the definition used is controversial. Zhu & Dodd (2000) refined the notion of phonological saliency as “a syllable-based, language-specific concept” (Zhu & Dodd, 2000:34). The more salient a syllable component is, the more noticeable it is to children, and the earlier it is mastered. Thus, tone was acquired before syllable-final consonants and vowels, and syllable-final consonants and vowels were acquired before syllable-initial consonants (see also previous discussion in section 2.1.3).

Phonological development in Cantonese

A few studies on phonological acquisition in Cantonese have appeared since the 1970s (Light, 1977; Tse, J., 1978; Tse, S.-M., 1982; Tse, C.-Y., 1991). These pioneer studies, reviewed by So & Dodd (1995), consisted of diary records of a small number of children. These studies reported the acquisition of tones to be earlier than that of segments; and both universal tendencies and language-specific factors were evident in the phonological acquisition of the children.

So & Dodd (1995) conducted the first large-scale cross-sectional normative study of phonological development in Cantonese. 268 Cantonese-speaking children aged between 2;00-5;11 were studied. A longitudinal study of tonal development by four children aged between 14 and 24 months was also incorporated. Based on a 90% criterion, the age of emergence of consonants is summarized in Table 2.12.

Table 2.12: Age of emergence for consonants in Cantonese

Age	90% criterion	75% criterion
2;00-2;06	n, p, t, j	p, t, m, n, ŋ, h, j, k, l, w
2;06-3;00	m, w, ŋ	f, s, p ^h , ts
3;00-3;06	h, k	t ^h , k ^h , ts ^h
3;06-4;00	l, p ^h , t ^h , k ^h	
4;00-4;06	f, s, ts	
>4;06	ts ^h	

Source: So & Dodd (1995:482).

So & Dodd (1995) compared the age of acquisition of consonants in their Cantonese-speaking children with the English-speaking children in the study by Prather et al. (1975). They claimed that in terms of order of acquisition, both Cantonese-speaking children and English-speaking children showed a rather similar order of sound classes acquisition: the early acquired ones were nasals, glides, bilabials, alveolar stops, followed by /h/ and /k/, and the late acquired ones were aspirated plosives, affricates, and voiced fricatives. However in terms of rate of acquisition, the Cantonese-speaking children were more rapid than the English-speaking children. 75% of the Cantonese-speaking children acquired all consonants by 3;06 compared to 4;00 for English-speaking children. The major error patterns of consonants were assimilation, cluster reduction, stopping, fronting, deaspiration and affrication.

Vowel errors were fewer than consonants. There are eight vowels /i, y, e, a, œ, a, e, ɔ, u/ in Cantonese (So, 2006), and ninety percent of the children in the youngest age group had acquired all vowels. Only fifteen children made two or more vowel errors. The most frequent vowel error was assimilation. There are nine tones in Cantonese: T1: high level, T2: high rise, T3: mid level, T4: low fall, T5: low rise, T6: low level, T7: high entering, T8: mid entering, T9: low entering. Tonal errors were even rarer. Only two children in the cross-sectional study made tonal errors. So & Dodd (1995) concluded that both universal tendencies and language-specific factors influenced the phonological acquisition in Cantonese.

2.3 CONCLUSION

Bilingual and multilingual phonological acquisition studies help to test existing theories of monolingual phonological acquisition. Cross-linguistic findings provide important clinical baseline information. Some similarities and differences in the rate, patterns and processes of acquisition are anticipated between monolingual acquisition of one language and the acquisition of more than one language. The similarities that exist might be attributed to similarities in learners' language acquisition device, world knowledge and cognitive abilities. Differences that exist might be because bilingual and multilingual learners are also subject to specifically bilingual or multilingual factors such as the unequal amount of input, and variable opportunities to use the languages, as well as cross-linguistic influences among the languages being acquired. Specific language combinations might lead to specific patterns of phonological acquisition, and therefore different language combinations deserve investigation, in particular combinations of typologically different languages. Research on bilingual Chinese children over the last decade has generally reported two separated phonological systems that somehow interact, resulting in some atypical error patterns that are rarely observed in typically developing monolinguals but are commonly observed in phonologically disordered monolingual children. Such atypical error patterns have been associated with underspecified phonological rules. Some of these studies have reported a general delay in phonological development, possibly due to the methodological shortcomings of the study namely: misinterpreting correct production as incorrect production by not considering the input language (phonological) model that the children are exposed to, which is subject to dialectal influences. Future research on bilingual or multilingual Chinese children in the context of Asia particularly ought to consider these sociolinguistic variants. Recent research has shown that the acquisition of more than one language in a bilingual community might enhance phonological awareness and phonological knowledge, resulting in a faster rate of phonological acquisition compared to that of monolingual learners. Multilingual phonological acquisition is even more under-explored than bilingual phonological acquisition. Multilingual phonological acquisition in the kind of multilingual community that exists in many countries in Asia is non-existent. Future research on multilingual phonological acquisition in Asian countries is desired in order to contribute knowledge to the currently sparse literature.

CHAPTER 3

LOCAL VARIETY OF LANGUAGES

3.0 INTRODUCTION

In this chapter, the socio-linguistic profile in Malaysia will be described. The local varieties of the languages spoken by the ethnic Chinese population will be described in some detail, drawing on both the existing local literature and a new analysis of the pronunciation of two adult speakers. The language varieties in question are English (Manglish), Mandarin (Maldarin) and Malay (ChinMalay).

3.1 SOCIO-LINGUISTIC SITUATION

Malaysia is a country in Southeast Asia. It is made up of East Malaysia (Northern Borneo island) and Peninsula Malaysia. The Malay people probably moved into the country around 3,000-3,500 years ago (Asmah, 2003). Europeans- first Portuguese, followed by Dutch and British, arrived in the 16th century. In the 19th century, immigrants from Southern China and from Southern India arrived (Lee & Tan, 2000). The Federation of Malaya gained independence from the British in 1957, and joined with Sabah, Sarawak and Singapore to form the Federation of Malaysia in 1963 (Andaya & Andaya, 1982). In 1965, Singapore withdrew itself from the Federation of Malaysia and became a country of its own.

Southeast Asia is a highly multilingual region: multilingualism in this region has been intensified by factors such as immigration, trading and missionary activities earlier in its history (Asmah, 2003). Today, Malaysia is a multiracial, multilingual country with three main ethnic groups and four main languages. Malays make up the largest ethnic group (53.68%), Chinese the second (31.35%), and Indians the third (12.78%), followed by foreigners (1.87%) and others (0.32%) (Statistics Department of Malaysia, 2000). Kuala Lumpur is the capital, and the largest city of Malaysia.

The national language of Malaysia is “Bahasa Malaysia” (literally “Malaysian Language”; thereafter Malay), a language of the Austronesian language family (see further discussion in section 3.2.3). It is a dominant language in government departments (Benson, 1990; Gill, 1993). English is a strong second language. It has been a compulsory second language in primary school and secondary school since 1967, when Malay was promoted as the national language (Wong & Thambyrajah, 1991; Lowenberg, 1991; Lowenberg & McArthur, 1992; Baskaran.

2004). It is widely used in the universities despite the change to Malay as the medium of instruction (Benson, 1990). English is also widely used in mass media (Wong & Thambyrajah, 1991) and the private sector (Gill, 1993). It is generally used for both intranational and international communication purposes (Gill, 1999; Rajadurai, 2004). Even in the government departments, English is frequently used in verbal communication (Wong & Thambyrajah, 1991); it is a useful lingua franca among the diverse ethnic groups. It is preferred to Malay by Chinese and Indians for a variety of reasons including educational and social (Preshous, 2001). It is not the first language of any local ethnic group; hence it is ethnic-bias free, whereas Malay is perceived by the non-Malays as a language of the Malays rather than a language of Malaysians. The Chinese “find it unthinkable to speak in Malay with another Chinese” (Ting, 2001:55). The older generations who have attended the English-medium schools during the British colonial days continue to use English while maintaining their ethnic mother tongue. Some of the younger generations have used English as a dominant home language (Benson, 1990; Preshous, 2001), in particular the Chinese.

Two other major languages, used by the second and the third largest ethnic groups, are Mandarin and Tamil. Mandarin and Tamil are the representative official languages of the Chinese and Indian populations in the mass media, for religious matters and for vernacular education (Baskaran, 2004). In Malaysia, pre-school education is not compulsory. Primary school and secondary school education are compulsory for children between the ages of 6 and 16. Parents are free to choose between Malay, Mandarin or Tamil as the medium of instruction by sending their children to the state school, Mandarin vernacular school or Tamil vernacular school. English is a compulsory second language in primary school and secondary school. Thus, students from state schools are generally bilingual i.e. Malay and English, whereas students from vernacular schools are generally multilingual (David, 2003) i.e. Mandarin/Tamil, Malay and English.

Within each ethnic group, there exist several sub-ethnic groups, each speaking a dialect of its own. The Chinese ethnic group in particular is highly diversified (Asmah, 2003). Lee & Tan (2000) reported that the main Chinese dialect groups are Hokkien, Hakka, Cantonese, Teochew and Hainan. These Chinese dialect groups are scattered all over Malaysia; they are commonly associated with specific regions, and their dialects are used as a lingua franca there. For instance, in Kuala Lumpur, Cantonese is widely used, though there are slightly more Hokkien than Cantonese, followed by Hakka. Mandarin becomes a useful Chinese lingua franca among these diverse Chinese dialect groups.

In summary, the typical situation is that ethnic Chinese people normally speak in Mandarin, Chinese dialects or English with each other, and in Malay and/or English with a Malay or Indian. Ethnic Chinese (and Malay) do not speak in Tamil with Indian people because they do not learn Tamil in school, and vice versa. As most Malaysians have several languages and dialects at their disposal, code switching i.e. “the use of more than one language/dialect within a turn of utterance” (David, 2003:1) is a predominant speech style in Malaysia. For instance, an ethnic Chinese person may switch between a Chinese dialect and English, or between Mandarin and English, when talking to a Chinese interlocutor who is familiar with the language and/or the dialect; and switch between English and Malay when talking to a Malay or Indian interlocutor who knows both the languages.

3.1.1 Malaysian Chinese

The Malaysian Chinese are descendants of Chinese who migrated from China in the nineteenth century and reside in Malaysia (Lee & Tan, 2000). The Malaysian Chinese are culturally closer to the Singaporean Chinese than the Indonesian Chinese, Filipino Chinese and Thai Chinese, owing to a shared heritage and history as well as close geographical proximity (Wikipedia Encyclopedia, 2005c). Singapore was part of the Federation of Malaysia between 1963 and 1965. Many Malaysian Chinese have relatives in Singapore. Some Malaysian Chinese reside and work in Singapore (Wikipedia Encyclopedia, 2005c). The languages and dialects used by the Malaysian Chinese are very similar to Singaporean Chinese e.g. Mandarin (see Chen, 1983, 1986; Yao, 1999; Yew, 1999), English (see Tongue, 1979; Gupta, 1994; Lim, 2001; Baskaran, 2004; Wee, 2004; Wikipedia Encyclopedia, 2005d, 2005e), Malay and other Chinese dialects such as Hokkien and Teochew.

3.2 LOCAL VARIETY OF LANGUAGES

In this section, the three major languages spoken by the Chinese in Malaysia will be described. In the present study, the term “Mandarin” is used, as it is commonly used in Malaysia. It is equivalent to “Putonghua” in China. The term “Malaysian English”, nicknamed “Manglish”, refers to the local variety of English. The terms “Maldarin” and “ChinMalay” have been coined for the present study, to refer to the local varieties of Malaysian Mandarin and Chinese Malay respectively.

In the present study, the benchmark for assessing children's phonological development is the adult input model of Manglish, Maldarin and Chin Malay, as described in the local research literature, supplemented by the pronunciation of two Chinese nursery teachers. The pronunciation of the teachers was studied for several reasons:

1. Most phonological acquisition studies (e.g. most bilingual phonological studies compiled in Zhu & Dodd, 2006a) do not systematically consider local adult input patterns, which has sometimes resulted in misinterpretation of adult phonological variants as developmental error patterns in the children (see Chapter 2).
2. A normative description of the adult pronunciation, however small-scale, is therefore highly desirable (see Khattab, 2002, 2006), since the adult input model is said to be an important contributing factor in bilingual and multilingual phonological development (see Chapter 2).
3. The nature of the cross-sectional phonological study approach is to compare a sample that shared similarities. It is therefore essential to look at the similarities of the input languages that the multilingual children are constantly exposed to in their shared community.
4. The parents of the sixty-four Chinese children do not speak Malay with the children at home (see Appendix 1). In order to have a consistent reference point for the Malay pronunciation of all the children, the adult teachers with whom the children learn Malay alongside English and Mandarin in the nursery are studied (see Chapter 5).
5. There has not yet been any empirical study of Malaysian Chinese speakers' pronunciation of Malay (see section 3.2.3.3).
6. This analysis of teachers' pronunciation further has an advantage of tackling phonological variants that are lexically-based (see section 3.2.1.4, 3.2.2.3 & 3.2.3.3).

The two Chinese teachers were randomly selected from the nursery where the present study was undertaken. Both teachers are typical local Chinese nursery teachers and their demographic background is summarized below:

1. The teachers are female, one aged forty and the other aged twenty seven. In terms of gender and age range they are typical of large majority of Chinese nursery teachers in Malaysia.

2. Both teachers are secondary school graduates but do not have higher education qualifications. This is typical of the vast majority of local Chinese nursery teachers in Malaysia.
3. Both teachers had received primary Chinese school education, and so are fluent in English, Mandarin and Malay (see Chapter 3), the three languages under study in the present research.
4. Both teachers speak the local varieties of the English, Malay and Mandarin languages alongside the Southern Chinese dialect Cantonese, a dominant regional dialect associated with Kuala Lumpur (see section 3.1).
5. Both teachers had received some exposure to Southern Chinese dialects other than Cantonese at home (see above 4): Hakka for one teacher, and Hokkien and Teochew for the other teacher.

The teachers were asked to do the same single-word phonology naming tests as the children subjects in the present study for English, Mandarin and Malay (see Appendix 4). The teachers' test sessions were audio-recorded and transcribed by the researcher, the transcription was then checked by another experienced phonetician (see Chapter 5). The phonological variants present in the teachers' pronunciation together with those features commonly cited in local literature are taken as acceptable adult targets when scoring the children's responses to the three phonology tests.

3.2.1 Malaysian English (ME)

The term Malaysian English, nicknamed "Manglish" or "Malenglish" (Baskaran, 1994; McArthur, 1998; Wikipedia Encyclopedia, 2005d) refers to the range of sub-varieties of English used in Malaysia (Newbrook, 1997). Malaysian English (thereafter ME) is a local variety of English, with forms that have been modified to satisfy local needs (Rajadurai, 2004). Research on ME has focused more on the macro-sociolinguistic aspects such as status and attitude, than the micro-sociolinguistic aspects such as phonology and syntax (Newbrook, 1997).

The varieties of English spoken in Malaysia and Singapore have often been discussed together (e.g. Tongue, 1979; Platt, 1977, 1982; Platt & Weber, 1980; Platt, Weber & Ho, 1983, 1984; Brown, 1988; Ooi, 2001). ME is very similar to Colloquial Singapore English nicknamed "Singlish" (thereafter SE) (Lim, 2001; Wikipedia Encyclopedia, 2005e). The main differences between ME and SE are in the usage of lexis and syntax (Gupta, 1994; Lim, 2001); it is hard to differentiate these two English varieties (Tongue, 1979; Lim, 2001; Wikipedia Encyclopedia, 2005d) particularly at the level of phonology (e.g. Baskaran, 2004

c.f. Wee, 2004) by ethnic Chinese speakers of both countries who shared the same Southern Chinese dialect background.

3.2.1.1 The development of Malaysian English (ME)

The history of ME began with the British colonization in the country, from late 18th to mid 20th centuries. Generally ME developed through formal education (Platt et al., 1983). During the colonial period, the advantages of knowing English (e.g. better-paid jobs) resulted in many rich Chinese and Indians in the urban areas sending their children to the English-medium schools, whereas many Malay children in the rural areas attended the Malay vernacular schools (Platt & Weber, 1980; Platt, 1982; Platt et al., 1983). This has resulted in many local people knowing English with various levels of proficiency (Wong, 1981). English became a prestige language and a lingua franca amongst the diverse local ethnic groups (Platt et al., 1983; Lowenberg, 1991). In the English-medium schools, students from multiracial/multilingual backgrounds, notably Chinese, Malay and Indian, have always transferred their mother tongue linguistic features to their English language, resulting in the development of a distinctive local English variety (Augustin, 1982).

During the post-colonial period, following political independence in 1957, the need to aim at standard British English was no longer there. This has been recognized officially by the Ministry of Education. Moreover it is hard to aim at standard British English without the British native-speaker speech model (Wong, 1981). This, coupled with the enforcement of the 1969 language policy when Malay replaced English as the medium of instruction in schools and institutions, has resulted in the rapid development of ME, a local English variety, characterized by transfer features from Malay, Chinese and Indian languages and dialects (Augustin, 1982; Wong, 1982). Today, Malaysians are proud of ME and view it as an identity marker of Malaysian (Wong, 1982). In informal situations, even proficient speakers of ME exaggerate their accents notably in their pronunciation in order to assert shared identity (Rajadurai, 2004).

3.2.1.2 Sub-varieties of Malaysian English (ME)

ME is not a uniform variety (Preshous, 2001), a range of sub-varieties of ME has been discerned. The past three decades or so have seen an upsurge in research of sub-varieties of ME (e.g. Tongue, 1979; Platt & Weber, 1980; Platt, 1982; Platt et al., 1983, 1984; Wong, 1981, 1982 & 1983; Augustin, 1982; Baskaran, 1987, 1994, 2004).

Some researchers have described ME sub-varieties in terms of style (Tongue, 1979). Other researchers have classified ME in terms of High and Low Varieties (Wong, 1981). Platt and Weber (1980, 1983) and Baskaran (1987, 1994, 2004) classified ME according to a continuum of social dialects or sociolects. Baskaran (2004) identified three sociolects in ME: acrolect, mesolect and basilect. These three sociolects are differentiated by features at the phonological, syntactical and lexical levels. The acrolect, the norm used for official matters such as school teaching, contains standard forms in both speech and writing. It is closer to standard British English. The mesolect, the informal style of ME, contains simplified forms in both speech and writing. It is the most common sociolect. The basilect, the uneducated style of ME, contains more sub-standard forms, it is used by speakers such as village pedlars when interacting with their customers such as tourists. With the exception of the basilect speakers, ME speakers are generally capable in switching between mesolect and acrolect depending on factors such as formality of the situation e.g. pronouncing dental fricatives /θ, ð/ in standard form in formal situations but simplifying them to [t, d] in informal situations.

3.2.1.3 Malaysian English (ME) phonology

Most researchers have described the phonological features of ME based on comparison with standard British English i.e. Received Pronunciation (thereafter RP)(e.g. Tongue, 1979; Wong, 1981, 1982; Jassem, 1993, 1994; Alias, 1995; Baskaran, 2004). Given the ethnic variety of speakers of ME, resulting from the multi-ethnic situation in the country, the question arises as to whether there are pronunciation differences along ethnic lines. Thus far, there is no in-depth research into Malaysian Chinese ME pronunciation per se, though most researchers have made an effort to identify the ethnic origin of phonological variants where necessary in the description of ME phonological variants e.g. RP /r/ is realised as an alveolar lateral [l] in Chinese speakers of English, but as an alveolar trill [r] in Malay and Indian speakers of English (Jassem, 1993; Alias, 1995; Baskaran, 2004).

3.2.1.4 Malaysian English (ME) phonological features

The description of salient phonological features of ME in this section is mainly based on the present analysis of the pronunciation of two nursery teachers (see Appendix 4) plus the informal observation of other Malaysian Chinese speakers' pronunciation of English. In addition, the studies by Baskaran (2004) and by Alias (1995) on ME, as well as the classic study by Tongue (1979) and the more recent study by Wee (2004) on SE are also consulted. As the list of possible phonological variants across the three sociolects is very long, the phonological variants presented here are amongst the most common variants used by educated mesolect and acrolect speakers. It can be difficult to determine to which of these

two sociolects of ME exactly a variant belongs; moreover some of them may be used by the basilectal speakers as well (Tongue, 1979; Baskaran, 2004). However, the examples of both standard and non-standard realisations of ME used in the analysis here are largely based on the informal communicative style of mesolectal ME alongside the formal school learning style of acrolectal ME. Both of which the nursery children subjects in the present study are constantly exposed to in their everyday school life. Future empirical studies are needed to identify the phonological variants associated with the three sociolects of ME.

Consonants

The total number of consonants in ME is the same as RP. The relationship of ME consonants to the RP consonant system can be described in terms of systemic simplification and structural simplification.

Systemic simplification

It is commonly reported in the literature that ME speakers always replace /θ, ð/ with [t, d]. In a more recent empirical study by Alias (1995), a total of approximately twenty variants for the pronunciation of each of these two consonants were identified in both formal and informal speech depending on factors such as linguistic environments (e.g. [ø, ʔ, d̥, t̥, d̥, ɸ, θ etc.] for /ð/ and [ʔ, t̥, t, ɸ, f, ð, etc.] for /θ/). Inconsistent usage of both standard and non-standard realisations of /θ, ð/ by individual speakers is also observed in the present study:

/θ/ realised as 1. [θ], [t̥] e.g. THIN → [θin], [t̥in]
 2. [f] e.g. MOUTH → [mauf]; TEETH → [tif]

/ð/ realised as 1. [ð], [d] e.g. THAT → [ðɛt], [dɛt]
 2. [θ], [d] e.g. MOTHER → [mɑθə], [mɑdə]

/v/ is replaced by [ʋ] or [w] in some Chinese speakers of ME. In addition, it is often devoiced to [f] in word-final position (see further discussion on “devoicing”). In the present study, /v/ is used inconsistently and interchangeably with [ʋ] by both teachers. The following examples are taken from the teachers’ pronunciation:

/v/ realised as 1. [v], [ʋ] e.g. VAN → [vɛn], [ʋɛn]
 DRIVING → [draivɪŋ], [draiʋɪŋ]
 2. [f] e.g. FIVE → [faif]

Several variants have been reported for /r/ e.g. [r, ɾ, ɻ, l] in past studies. Based on subjective observation, /r/ is often realised as [l] in some Chinese speakers. It is sometimes pronounced as an alveolar trill [r], presumably a result of influence from Malay. However, a mixture of standard and non-standard forms of /r/ may be used by the same speaker. The following examples are taken from the teachers' data:

/ɹ/ realised as: 1. [ɹ] e.g. RED → [ɹed]
 2. [ɹ], [r] e.g. ORANGE → [ɔɹentʃ], [ɔrentʃ]

Deaspiration

In some speakers, the voiceless plosives and affricate /p, t, k, tʃ/ can be somewhat unaspirated in non-final position. This is probably another transfer feature from Malay. These deaspirated plosives and affricate are used sporadically in the teachers' pronunciation:

/t/ realised as [t̥] e.g. TIGER → [t̥aigə]
 /tʃ/ realised as [t̥ʃ] e.g. CHICKEN → [t̥ʃik̥ən]

Devoicing

Voiced obstruents tend to be devoiced especially in word-final position. The following last three examples are taken from the teachers' data:

/b/ realised as [p] e.g. WEB → [wɛp]
 /d/ realised as [t] e.g. RED → [ɹet]
 /g/ realised as [k] e.g. FROG → [frɔk]
 /v/ realised as [f] e.g. FIVE → [faif]
 /z/ realised as [s] e.g. PYJAMAS → [pɛdʒaməs]
 /dʒ/ realised as [tʃ] e.g. ORANGE → [ɔɹentʃ]

Furthermore, /ʒ/ is also sometimes replaced by its voiceless counterpart [ʃ] in word medial position. /z/ is also sometimes replaced by its voiceless counterpart [s] in word medial position though it is more lexically governed:

/ʒ/ realised as [ʃ] e.g. TELEVISION → [telɪvɪʃən]
 /z/ realised as [s] e.g. HUSBAND → [hasbən]

Voicing

Conversely some researchers have reported voicing of the voiceless fricatives /s, ʃ/ in inter-vocalic position (Tongue, 1979) plus final position (Baskaran, 2004) in some lexical items. Based on informal observation of Chinese speakers of ME in general, this simplification holds true for inter-vocalic position:

/s/ realised as [z] e.g. DECEMBER → [dizembə]

/ʃ/ realised as [ʒ] e.g. PRESSURE → [pɹɛʒə]

Glottalisation

Final plosives are unreleased with the preceding vowels glottalised, or are replaced by a glottal stop [ʔ]. Glottalisation can be described as one of the most salient phonological features of ME (Tongue, 1979; Wee, 2004). These features are also present in the teachers' pronunciation:

/p/ realised as [pʰ] e.g. CUP → [kʌp], [kʌʔpʰ]

/b/ realised as [bʰ] e.g. WEB → [wɛʔbʰ]

/t/ realised as [tʰ] e.g. PLATE → [plɛt], [plɛʔtʰ]

/d/ realised as [ʔ] e.g. BREAD → [brɛd], [brɛʔdʰ]

/k/ realised as [ʔ] e.g. CLOCK → [klɔk], [klɔʔ]; SNAKE → [snek], [sneʔ]

/g/ realised as [ʔ] e.g. DOG → [dɔʔ]

Structural simplification

Deletion

Final /l/ is frequently omitted when occurring after /ɔ, o, u, ə/. This is also observed in the present study. In addition, /l/ is deleted when it is the first consonant of a medial consonant sequence in a few lexical items like ALSO, ELBOW:

/l/ realised as [∅] e.g. GIRL → [gɛ], TABLE → [tebə], PENCIL → [pensə],
SMALL → [smɔ]

Cluster reduction

Final consonant cluster reduction is another salient feature of ME. This is not surprising as there are no consonant clusters in either Mandarin or Malay consonant systems. The upper limit of consonant cluster realisation for most speakers is two or three segments; the following examples are taken from Wee (2004:1026):

/ksts/ realised as [ks] e.g. TEXTS → [teks]

/mpst/ realised as [mst], [ms] e.g. GLIMPSED → [glimst], [glims]

Schwa insertion

Schwa [ə] is frequently inserted in words like LITTLE, BUTTON where /l/ and /n/ have occupied the nucleus position of the respective syllable (syllabic), [ə] takes over the nucleus position and reassigns /l/ and /n/ to the word final position (Wee, 2004):

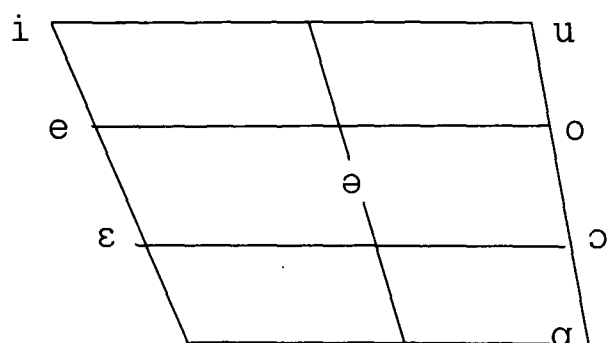
/l/ realised as [əl] e.g. LITTLE → [litə(l)]

/n/ realised as [ən] e.g. BUTTON → [batən]

Vowels

In general the vowels of ME deviate more from RP than do the consonants. There are twelve monophthongs, eight diphthongs and five triphthongs in RP (Roach, 1994). It is generally agreed that the number of vowels in ME is smaller than in RP (Tongue, 1979; Baskaran, 2004; Wee, 2004; Wikipedia Encyclopedia, 2005e). In the present study, it is posited that there are eight monophthongs, five diphthongs, with virtually no triphthongs in ME. Figure 3.1 displays the monophthongs in ME, using International Phonetic Alphabet (IPA) vowel quadrilateral (The International Phonetic Association, 1999). Individual speakers may use slightly different vowel qualities when pronouncing these monophthongs. For example, /ɑ/ may be pronounced in a slight forward and raised position as [ɛ] and so on. The five diphthongs of ME are /ai, ɔi, au, uə, iə/.

Figure 3.1: The monophthongs of Malaysian English (ME)



Some of the RP open vowels are raised in ME. This is also observed in the pronunciation of the teachers:

/ɒ/ is realised as [ɔ] e.g. DOG → [dɔg]

/æ/ is realised as [ɛ] e.g. VAN → [vɛn]

The unstressed schwa vowel of RP has several realizations. It is realised as [o] or [ɑ] depending on the orthography i.e. “o” (e.g. COMPUTER) for the former, and “a” (e.g. BANANAA) for the latter. The final unstressed schwa vowel [ə] is used inconsistently and interchangeably with [ɑ] in the word BANANA by both teachers:

/ə/ is realised as 1. [o] e.g. COMPUTER → [kɒmpjʊtə]

2. [ə], [ɑ] e.g. BANANA → [bənənə], [bənənɑ]

The distinction between long vowels and short vowels is not found in ME. RP long vowels are always realised as short vowels in ME. Hence the distinction between BEAT and BIT is lost, they are both pronounced as [bit]. This tendency to shorten long vowels presumably results from the influence of both Mandarin and Malay short vowel systems. The following examples are taken from the teachers’ speech data:

/i:/ is realised as [i] e.g. leaf → [lif]

/ɜ:/ is realised as [ə] e.g. girl → [gə]

/u:/ is realised as [u] e.g. blue → [blu]

/ɔ:/ is realised as [ɔ] e.g. horse → [hɔs]

/ɑ:/ is realised as [ɑ] e.g. pyjamas → [pɛdʒɑməs]

Some diphthongs in RP are always monophthongised in ME. The following first two examples are observed in the teachers' speech:

- /eɪ/ realised as [e] e.g. plate→[plet]
/əʊ/ realised as [o] e.g. yoyo→[jojo]
/eə/ realised as [ɛ] e.g. square→[skwɛ]

Triphthongs are neglected in previous studies. In the present study, it is observed that similar to diphthongs, RP triphthongs are split into two chunks with the second element /ɪ, ʊ/ being replaced by semi-vowel [j, w]. The following second and third examples are observed in the teachers' pronunciation:

- /aɪə/ realised as [ɑjə] e.g. FIRE→[fɑjə]
/aʊə/ realised as [ɑwə] e.g. FLOWER→[flɑwə]
/eɪə/ realised as [ejə] e.g. CRAYON→[krejən]
/əʊə/ realised as [owə] e.g. LOWER→[lowə]
/ɔɪə/ realised as [ɔjə] e.g. LOYAL→[lɔjə]

Prosodic features

There has been an upsurge in research on prosodic features of SE in the recent literature (see e.g. Deterding, 1994; Brown, Deterding & Low, 2000). Empirical study of prosodic features of ME is comparatively rare (see e.g. Wang, 1987). As there is no substantial research on Malaysian Chinese ME prosodic features per se, the discussion in this section is mainly based on the present analysis of the two nursery teachers' prosody patterns alongside informal observation of other Chinese speakers. Research on Singaporean English prosody, which is more Chinese-based, is also consulted. Thus far, research on prosodic features of ME has mostly concentrated on rhythm, word-stress, pitch and intonation.

Rhythm

One of the most prominent features of ME is its syllable-timed rhythm sometimes described as "staccato rhythm" or "machine-gun rhythm" (Platt & Weber, 1980; Augustin, 1982; Tay, 1993) which is presumably a result of influence from Mandarin and Malay. RP has a stress-timed rhythm where stressed syllables occur at fairly regular intervals. The unstressed syllables have to be squeezed in between the stressed syllables, which often results in further reduction in the syllables (Wee, 2004). In contrast, in the syllable-timed rhythm of ME, all syllables whether stressed or unstressed take up approximately the same amount of time. This syllable-timed rhythm together with a lack of liaison between words

(Augustin, 1982) plus the shortening of vowels described in the previous section has resulted in the jerky, staccato effect of ME rhythm.

Word stress

From early studies in the 1970s, word stress has already been described as “the single feature which is primarily responsible for the immediate recognisability of the English in Singapore and Malaysia” (Tongue, 1979:33). Various differences between ME and RP stress patterns have been reported in the literature. The following examples are taken from Tongue (1979:33-38), some of which are also observed in the present analysis, for example:

1. Stress shift to a later syllable in some nouns, verbs and adjectives (e.g. YE¹LLLOW, DA¹DDY, BANA¹NA, PYJA¹MAS, COM¹MENT, COM¹PETENT) which, in some cases (e.g. COM¹MENT) has resulted in the loss of distinction between a noun and a verb.
2. Stress shift to final syllable on nouns ending in -ASM and -ISM (e.g. ENTHUSI¹ASM) and verbs ending in -ISE (e.g. ORGA¹NISE).
3. Stress shift to the -ATE syllable in both participle forms -ING and -ED in verbs (e.g. CALCU¹LATING, NOMI¹NATED).
4. Stress is placed on the same syllable of words of the -LOGY, -LOGIST, -LOGICAL category (e.g. TECHNO¹LOGY, TECHNO¹LOGIST, TECHNO¹LOGICAL) and thus the stress distinction between noun and adjective is lost.
5. Stress is shifted to the final word (normally final syllable) in a compound word (e.g. ¹BLACKBOARD vs. BLACK ¹BOARD are both pronounced as BLACK¹BOARD) and hence the contrast in meaning is lost.

On the whole, the tendency of shifting to a later syllable, especially in Chinese speakers, can be attributed to the influence of Mandarin. In Mandarin, in a word or phrase, the last syllable normally carries the primary stress, the initial syllable the secondary stress, and the medial syllable/s the weakest stress (Chao, 1968).

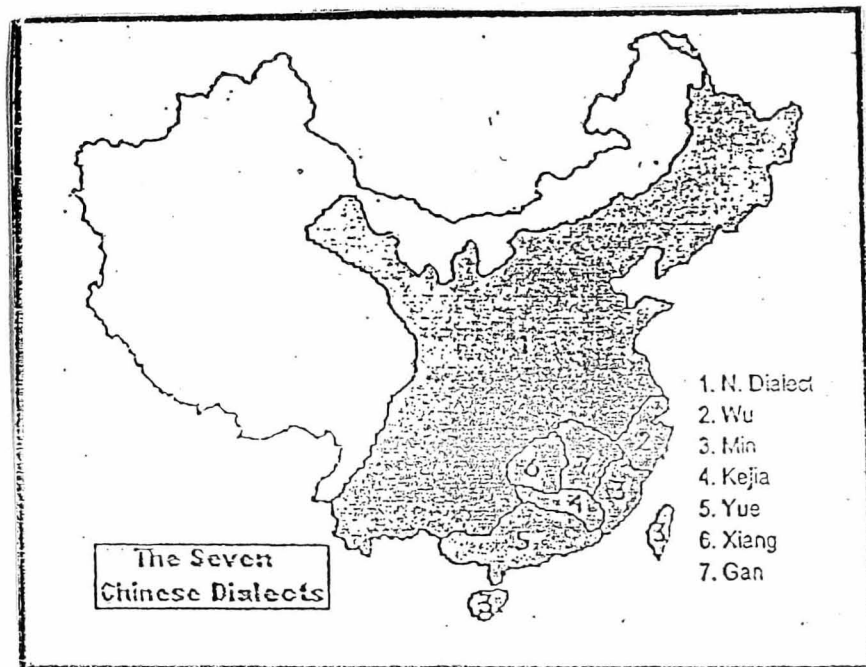
Pitch

It has long been observed that ME has a narrower pitch range than RP (see e.g. Tongue, 1979). In RP, variations of pitch (e.g. falling, rising, rise-fall) are used for a wide range of functions at both the word and the sentence levels. Pitch is used as one of the phonetic correlates for accentuation of words. It is also used to signify emphasis, contrast etc. in utterances. In contrast in ME, the function of pitch seems to be accomplished by lengthening of the final syllable. Lengthening of final syllable is used to emphasise one's point strongly or to contradict an assumption made by conversational partner. For example, a reply of "Working!" with a lengthened final stressed syllable to the question of "Are you working this week or taking leave?" can be interpreted as "I am working of course, and you should have known that!" (Example cited from Tongue, 1979:28-9).

3.2.2 Mandarin

The term "Mandarin" refers to "Beifanghua" (literally "Northern Dialect"), one of the seven major Chinese dialect groups in China. It is used by 2/3 of the entire population. The other six major dialect groups are Yue (Cantonese), Min (Fukkien), Keija (Hakka), Wu (Shanghainese), Xiang, and Gan (Lin, 2001) (see Figure 3.2):

Figure 3.2: The seven Chinese dialects



Source: Lin (2001:1)

The Mandarin language uses the Beijing dialect sound system as its phonology standard and the modern vernacular literature as its syntax standard. Mandarin is widely used in the mass media and schools or educational system in China. It is also used as a second dialect/language in non-Mandarin speaking areas in China (Lin, 2001).

Mandarin is a Sino-Tibetan language (Katzner, 1977). It is the largest spoken first language in the world. It has about 885 million speakers, 87% of whom live in China; most of the rest live in Taiwan, Singapore, Malaysia and Indonesia (Grimes, 2000). Mandarin is named “Putonghua” (literally “Common Speech”) in China, “Guoyu” (literally “National Language”) in Taiwan, and “Huayu” (literally “Chinese Language”) in Malaysia and Singapore. These three terms are used interchangeably among the Chinese communities in the world (Wikipedia, 2005f).

Mandarin is an official language in China, Taiwan, Hong Kong, Macao and Singapore (Wikipedia, 2005a). In general, it is a representative official language for the Chinese in Malaysia (Baskaran, 2004). It is a language of instruction in Chinese vernacular schools, and a Chinese lingua franca amongst the Chinese dialect groups in Malaysia (Lee & Tan, 2000)(see section 3.1).

Most languages in the world have adopted the “phonographic writing system”, but Mandarin has adopted the “logographic writing system” or the “character writing system” (Li & Thompson, 1987; Chen, 1999). From 1892-1958, several schemes of transcribing Mandarin characters have been proposed, for example, “zhuyin zimu” and “guoyu luomazi” (Chen, 1999). The most successful scheme was “hanyu pinyin fang’an” or “pinyin” in short (literally “spell sounds” or “Romanisation”), which was officially promulgated in China, in 1958.

In general, all twenty-six Roman alphabet letters are used in Pinyin except for “v” which is only used in transcription of foreign languages. The twenty-one initial consonants of Mandarin are represented by eighteen single alphabet letters namely: “b, c, d, f, g, h, j, k, l, m, n, p, q, r, s, t, x, z” plus three double alphabet letters namely: “ch, sh, zh” (see further discussion in section 3.2.2.1). The six vowels of Mandarin are represented by five single alphabet letters namely “a, e, i, o, u” plus one single alphabet letter with a diacritic “umlaut” “ü” (Xiandai Huayu Cidian, 1999)¹. Pinyin is not a full phonemic system, though some symbols are phonemically oriented, others are more phonetically oriented (Lin, 2001)².

¹ See DeFrancis (1984) and Ramsey (1987) for “rough approximations of Pinyin vowels and consonants in English”.

² See Li & Thompson (1987) and Lin (2001) for details.

Pinyin is now widely used in Mandarin computer software and dictionaries. It is used as an important tool to teach Mandarin pronunciation in school in China, as well as in other Southeast Asia countries. In Malaysia, since 1983, the local Ministry of Education has promoted the usage of Pinyin; Pinyin has been used as a phonetic aid to teach pronunciation of Mandarin in Chinese vernacular primary school since then.

3.2.2.1 Mandarin phonology

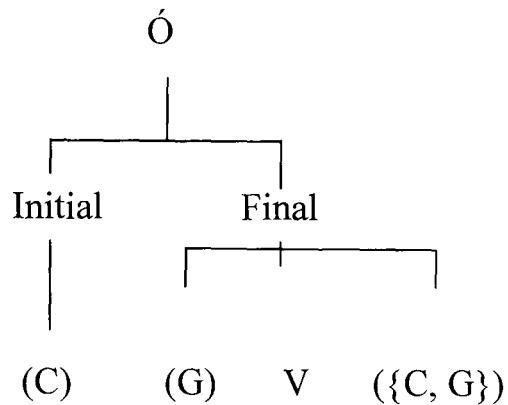
In this section, an overview of Mandarin phonology will be given. Some aspects of Mandarin phonetics are also described, as and when the illustration of certain aspects of Mandarin sound system is required. The IPA symbols are used where necessary throughout the discussion. Some of the unique phonetic transcription conventions sometimes used in works on Mandarin phonology which are not found in the IPA chart are replaced by the IPA symbols with relevant diacritics (e.g. /A/→/a/ for the open central /a/ (The International Phonetic Association, 1999). For typographical convenience, the diacritics used to represent the four basic tones in Pinyin, namely: high level (e.g. /pā/), rising (e.g. /pá/), falling-rising (e.g. /pǎ/), and high falling (e.g. /pà/) are replaced by digits 1, 2, 3, 4 respectively (e.g. /pā/→/p_a1/, /pá/→/p_a2/, /pǎ/→/p_a3/, /pà/→/p_a4/).

Syllables

The syllable is described as one of the most outstanding phonological features of Mandarin. Mandarin has always been regarded as “monosyllabic”, meaning each word consist of only one syllable. This impression of being monosyllabic is further reinforced by written Mandarin in that each character has a syllable that carries at least one meaning. However, in reality, most Mandarin words are made up of two morphemes i.e. disyllabic. According to a survey cited in Lin (2001), 74% of Mandarin words are disyllabic, only 12% are monosyllabic, and the other 14% are multi-syllabic. As such it would be more appropriate to describe Mandarin as monosyllabic at the morpheme level but disyllabic at the word level (Lin, 2001). Some researchers such as DeFrancis (1984) posit that the term “morphosyllabic” is a more appropriate term in describing Mandarin than “monosyllabic”. Another outstanding feature of Mandarin syllables is that, compared with English which has a large number of syllables i.e. more than 8,000 different syllables (DeFrancis, 1984), there exist only a small number of syllables in Mandarin i.e. about 1300 syllables when tonal difference is considered (Chen, 1999), and 405 syllables when tonal difference is disregarded (Lin, 2001).

Today, most Chinese researchers still prefer to use the traditional framework in describing Mandarin phonology i.e. in terms of “initials and finals” as opposed to “phonemic inventory” in the description of English phonology. The discussion of initials and finals of Mandarin in this section is mainly based on Lin (2001). Within the traditional framework, the Mandarin syllable consists of two parts namely: the “initial” and the “final” (see Figure 3.3):

Figure 3.3: The syllable of Mandarin



Source: Lin (2001:30).

Ó : a syllable.

C : a consonant (*C* in the final is a nasal).

V : a vowel.

G : a glide (a contextual variation of a close vowel).

(): optional.

{ } : only one element can appear at a time.

The initial is normally a consonant at the onset of the syllable, and the final is the rest of the syllable. The initial can be empty, and the syllable begins with a vowel which is still regarded as part of the final. The main (nucleus) vowel is compulsory but the rest are optional. The final is made up of three elements: 1. the “head” or “medial” (thereafter “medial”), 2. the “middle” and 3. the “tail” respectively. The medial is a close vowel variation of a glide: /i, u or y/; the middle can be any one vowel when a glide is absent, but when a glide is present, it is always a non-close vowel. The tail is made up of any one of the following four elements: a glide /i/ or /u/, or a nasal /n/ or /ŋ/. From Figure 3.3, we can see that, unlike the English language, there is no consonant cluster in the Mandarin syllable.

The above framework in Figure 3.3 yields a total of 12 basic syllable structures in Mandarin (see Table 3.1):

Table 3.1: The twelve syllable structures of Mandarin

Syllable structure	Word in Pinyin	IPA	Meaning
CGVC	qian2	tʃ ^h iɛn2	Money
CGVG	kuai4	k ^h uae4	Fast
CVC	zhan4	tʃan4	To stand
CVG	tou2	t ^h ou2	Head
CGV	zuo4	tsuo4	To sit
CV	ku1	k ^h u1	To cry
GVC	yang2	iɑŋ2	Goat
GVG	*wei3	uei3	Tail
GV	ya1	iɑ1	Duck
VC	*an4	an4	Dark
VG	*ou3	ou3	Double
V	wu3	u3	Five

**Except for “wei3, an4, ou3” which are not familiar to the children below the age of four years in the present study, all the above words/syllable structures are tested in the Malaysian Mandarin (Maldarin) Phonology Test described in Chapter 5.*

Further, the finals can be classified into four groups (see Table 3.2):

1. “Open-mouth finals”: begin with the non-close vowels [ɑ], [o] or [ɤ] and variants of these before final nasals.
2. “Close-teeth finals”: begin with the close front unrounded vowel [i].
3. “Close-mouth finals”: begin with the close back rounded vowel [u].
4. “Tense-lip finals”: begin with the close front rounded vowel [y].

Table 3.2: The finals of Mandarin (in Pinyin plus IPA in brackets)³

Type of final	Open-mouth	Close-teeth	Close-mouth	Tense-lip
		i [i]	u [u]	ü [y]
Simple	a [a]	ia [ia]	ua [ua]	
	o [o]		uo [uo]	
	e [ɤ]	ie [ie]		üe [yɛ]
	ai [ae]		uai [uae]	
Complex	ei [ei]		u(e)i [ueɪ]	
	ao [ao]	iao [iao]		
	ou [ou]	i(o)u [iou]		
	an [an]	ian [iɛn]	uan [uan]	üan [yɛn]
Nasal	en [ɛn]	in [in]	u(e)n [uən]	ün [yn]
	ang [ɑŋ]	iang [iaŋ]	uang [uaŋ]	
	eng [ʌŋ]	ing [iŋ]	ueng [uəŋ]	
	ong [ʊŋ]	iong [iuŋ]		

Source: adapted from Lin (2001:31).

In Table 3.2, the finals of Mandarin are further classified into three types:

1. Simple finals: consist of a monophthong only.
2. Complex finals: consist of a diphthong or a triphthong.
3. Nasal finals: end with a nasal consonant.

From Table 3.2, we can see that there are six monophthongs, nine diphthongs and four triphthongs (with variants before nasals) in Mandarin, these finals together with the initials will be described under “consonants” and “vowels” in the following sections in order to facilitate comparison with English and Malay.

³ See Xu (1993) for details of classification, phonetics and phonology of these finals which falls beyond the scope of the present study.

Consonants

Opinion differs amongst researchers concerning the consonants of Mandarin (Chen, 1999). Most researchers posit that there are altogether twenty one initial consonants and two final consonants (n, ŋ) in Mandarin (see Table 3.3). Others (e.g. Lee & Zee, 2003) have included /w, j/. In most research (e.g. Zhu & Dodd, 2000), /w, j/ are treated as medial glides /i,u, y/ between syllable initial consonant and main vowel (see Figure 3.3). The discussion on consonants in this section and vowels in the following section is mainly based on Norman (1988), Lin & Wang (1992) and Xu (1993).

Table 3.3: The consonants of Mandarin

Place \ Manner	Bilabial	Labio-dental	Alveolar	Retroflex	Palatal	Velar
Stop	p p ^h		t t ^h			k k ^h
Nasal	m		n			ŋ
Affricate			ts ts ^h	tʂ tʂ ^h	tɕ tɕ ^h	
Fricative		f	s	ʂ	ɕ	x
Approximant				ɻ		
Lateral approximant			l			

All of the above twenty two consonants can serve as the initial consonant except for /ŋ/. On the other hand, only two consonants /n, ŋ/ can serve as the final consonant. As mentioned earlier, there are no consonant clusters in Mandarin. There are two sets of potential syllabic consonants i.e. the alveolars /ts, ts^h, s/ and the retroflexes /tʂ, tʂ^h, ʂ, ɻ/ (see further discussion on “vowels” later in this section).

In general, Mandarin consonants can be classified into two primary classes: obstruents and sonorants (Norman, 1988):

1. Obstruents: stops, affricates and fricatives.
2. Sonorants: nasals, oral approximants and lateral approximants.

The obstruents are “voiceless” and the sonorants are “voiced”. Under this broad grouping, the two groups of “stops” and “affricates” are further divided into two series: aspirated and unaspirated:

1. Aspirated: /p^h, t^h, k^h; ts^h, tʃ^h, tʂ^h/.
2. Unaspirated: /p, t, k; ts, tʃ, tʂ/.

Different from the English language, “voicing” is not a distinctive feature in Mandarin but “aspiration” is. The “aspirated” consonants are strongly aspirated, whereas the “unaspirated” consonants are lenis which often gives the false impression of being voiced (Norman, 1988).

There are four labials: three bilabials /p, p^h, m/ and one labio-dental /f/. There are seven alveolars: /t, t^h, n, l/ are produced with the tongue tip placed against the upper alveolar ridge, whilst /ts, ts^h, s/ are produced with the tongue tip placed against the back of the upper teeth (or the lower teeth), in a slight more forward position than that of /t, t^h, n, l/.

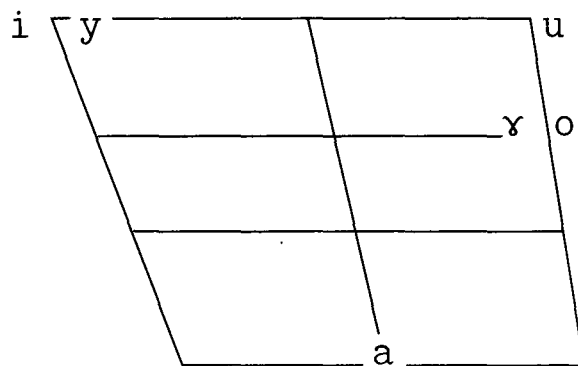
All four retroflexes /tʂ, tʂ^h, ʂ, ʐ/ are produced with curling of the tongue tip towards the hard palate (front part or middle part). Of all six classes of sounds (in terms of place of articulation), the alveolars and the retroflexes are most variable in terms of tongue tip placement. The description of /ʐ/ is debatable. It has been described as /z/, the voiced counterpart of /ʃ/. Nevertheless such description has been disputed as it would mean that “voicing” is a distinctive feature for Mandarin. Moreover, /ʐ/ in Mandarin is produced with much less (near zero) friction, it is like a semi-vowel. In a more contemporary empirical study by Lee & Zee (2003) however, the traditional description of all four retroflexes /tʂ, tʂ^h, ʂ, ʐ/ has been challenged, they were replaced by apical (tongue tip) post-alveolars /tʃ̟, tʃ̟^h, ʃ̟, ʐ̟/ respectively.

The palatals /tʃ, tʃ^h, ʃ/ are produced with the tongue blade placed against the front part of the palate and the tongue tip resting on the back of the lower teeth. The velars /k, k^h, ŋ, x/ are produced with the back of the tongue placed against the soft palate.

Vowels

Most researchers posit that there are six main monophthongs in Mandarin namely: /i, y, a, ʏ, u, o/ as illustrated in Figure 3.4:

Figure 3.4: The main monophthongs of Mandarin



Three other commonly cited marginal monophthongs are /ɛ/, /ə/ and /ɤ/. /ɛ/ sometimes pronounced as [eɪ] is used only as a conversation particle expressing speaker's emotion such as agreement and surprise. /ə/ is only found in weakly stressed syllables. /ɤ/ is a retroflexed central vowel, it is only found in isolation or in rhotacisation (suffix-*r*)(see further discussion on “rhotacisation” later in this section). Figure 3.4 displays the simple vowels in Mandarin. Individual speakers may use slightly different vowel qualities when pronouncing these vowels. For instance, the open central /a/ may be pronounced in a slight forward position or in a slight backward position (Lin & Wang, 1992).

There are nine diphthongs and four triphthongs in Mandarin namely: /ae, ao, ei, ou, ia, ie, ua, uo, ye/ and /iao, iou, uae, ueɪ/ (see also Table 3.2). The nine diphthongs are divided into two groups: “on-glide” and “off-glide”. In on-gliding diphthongs (/ia, ie, ua, uo, ye/), the second element is pronounced slightly louder and longer whereas in off-gliding ones, the first is (/ae, ao, ei, ou/). For all four triphthongs, the middle element is pronounced slightly louder and longer. Overall, the element which is produced with a lower tongue-positioning and a bigger mouth-opening appears louder and longer (Lin & Wang, 1992; Xu, 1993).

Some vowels in Mandarin have several variants. The close front unrounded “tongue-blade” vowel /i/ when occurring after the two sets of potential syllabic consonants in Mandarin namely: alveolars /tʂ, tʂʰ, ʂ/ and retroflexes /tʂ, tʂʰ, ʂ, ʃ/, represent a “tongue-tip” (apical) vowel [i̥] (commonly annotated as [ɿ] after the alveolars, and [ʅ] after the retroflexes⁴ in the literature of Chinese linguistics)(Lin & Wang, 1992; Xu, 1993).

As with the consonants, there are controversies over the description of some vowels in Mandarin. Amongst others, the status of vowels /i/ and /u/ in the four diphthongs /iə, iɛ, uə, uo/ and the four triphthongs /iəu, iou, uəɛ, uɛɪ/ remains an outstanding problem (Zhu & Dodd, 2000; Zhu, 2002). Traditionally, they have been described as “medial sounds” or “prenucleus glides” between the syllable-initial consonant and the main (nucleus) vowel (see Figure 3.3). Whether or not these medial glides should be considered as “semi-vowels” at syllable-initial position is debatable. Yin (1989) and Wang (1989) posit that these sounds should be considered as part of the “onset” and not the “coda” (c.f. the “initial” and the “final” within the traditional framework) in their proposed modern framework for Mandarin.

Rhotacisation

Most finals in Mandarin can undergo “rhotacisation” (“er-hua”), a phonological process which attaches suffix-*r* to a syllable in the syllable-final position. This suffix-*r* is associated with the word “er” [ʅ] (literally “son”) in Mandarin, thus making the rhotacised syllable (word) denotes “something common, familiar or small” (Zhu, 2002:38). This suffixation of -*r* in Mandarin can occur in nouns, adjectives and verbs, for example: PAN2→[pənʅ2] (plate), GAO1GAO1DƏ1→[gəo1gəo1dəʅ1] (rather tall), WAN2→ [wanʅ2] (to play) (Examples taken from Duanmu, 2000:195). In general, rhotacisation is commonly used in the speech of Mandarin speakers in Beijing. However, it is rarely used in the speech of Mandarin speakers in Southern China (Li & Thompson, 1981; Norman, 1988; Gao, 2000). It has therefore become a distinctive feature to distinguish speakers of Mandarin from Northern China to Southern China (Norman, 1988).

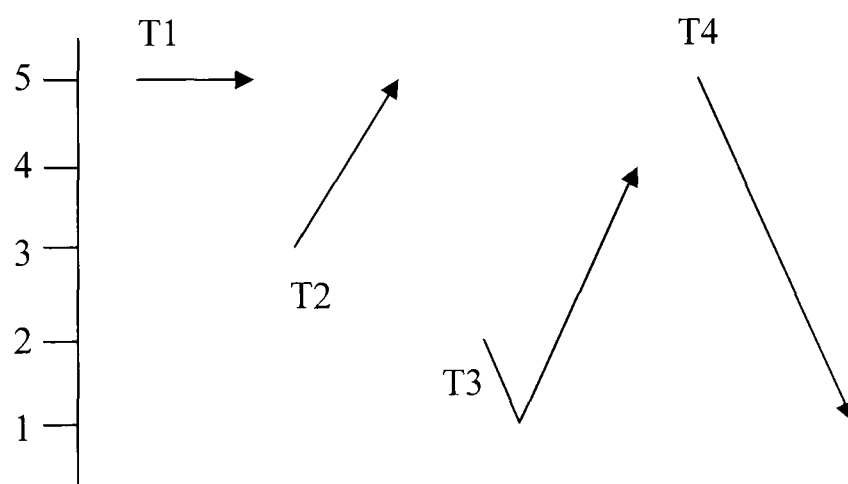
Tones

⁴[ɿ] after the alveolars is realized as a weak syllabic prolongation of the preceding alveolars; and [ʅ] after the retroflexes is realized as a weak syllabic retroflex continuant (Norman, 1988).

Tone is probably the most well-known phonological feature of Mandarin (DeFrancis, 1984; Lin & Wang, 1992). Mandarin is a tonal language with four basic tones. Like consonants and vowels, tone is also used to distinguish word meaning in Mandarin (Duanmu, 2000). Tones are perceived as differences in pitch, though intensity and duration are also contributing variables to the perception of tones (Norman, 1988). Acoustically, perceived pitch is measured by fundamental frequency (F0) (Duanmu, 2000; Lin, 2001). Phonetically, pitch is produced with tensing of the laryngeal muscle (Xu, 1993; Lin, 2001). Pitch is used to encode meaning in all languages, usually at the phrase or sentence levels where it is called “intonation”; only in some tonal languages like Mandarin does it involve the morpheme/word level called “tone” (Lin, 2001). Tone is said to have given Mandarin “a distinctive musical or singsong quality” (DeFrancis, 1984:46).

Traditionally, for ease of reference, the four tones of Mandarin have been called the 1st Tone, 2nd Tone, 3rd Tone and 4th Tone (thereafter T1, T2, T3 & T4) (Chao, 1968; Lin, 2001). For years, several schemes have been proposed to transcribe the four basic tones in Mandarin (Zhu, 2002). The most famous scheme is the 5 point-pitch scale proposed by Chao (1930 & 1968). The pitch range and movement of all four tones in Mandarin can be plotted on this scale, with 5 being the highest and 1 being the lowest (see Figure 3.5):

Figure 3.5: The four tones of Mandarin (Putonghua)



1. T1 (high level): produced with a pitch start at the highest level, and stays level (55).
2. T2 (rising): produced with a pitch start at the middle level, follow by a rise all the way up to the highest level (35).

3. T3 (falling-rising): produced with a pitch start at fairly low level, goes down to the lowest level before goes up to the fairly high level again (214).
4. T4 (high-falling): produced with a pitch start at the highest level and goes down to the lowest level (51).

The Pinyin diacritic of tones is a simplified version of the above with the tone mark being placed over the main vowel generally. Digits 1 to 4 are also frequently used to annotate the four tones respectively for typographical ease.

Neutral tone

In fact, in addition to the four basic tones of Mandarin, phonetically there is another tone called “neutral tone” (“qingsheng” literally “light tone”) commonly annotated as T0. Referred to as “weak stress”, neutral tone has a much reduced pitch range and duration in Mandarin (Chao, 1968). In weakly stressed syllables, “any of the 4 basic tones can lose their inherent tone and be “neutralised” into this short and weak tone” (Lin, 2001:48). Grammatical particles and affixes (e.g. “le⁴”, “zi³” as in XIE²ZI³→[xi²zi⁰]), as well as the second element of reduplicated nouns, verbs and adjectives (e.g. HUA⁴HUA⁴→[xu⁴xu⁰]), are said to have a neutral tone (Chen, 1999). The pitch of the neutral tone is determined by the preceding basic tone. In general, neutral tone is observed “half-low” after T1, “middle” after T2, “half-high” after T3, and “low” after T4 (Chao, 1968).

The nature of neutral tone remains controversial. Chen (1984) reported huge discrepancies amongst Mandarin dictionaries with regards to lexical neutral tone annotations based on his survey. The instability of neutral tone (in terms of “stress”) was observed not only in these written sources but also in the speech of individual speakers. As with the case of rhotacisation, speakers outside the Beijing area are found to use neutral tone much less frequently (Chen, 1999).

Tone sandhi

Tone sandhi (“biantiao” literally “alternations of tones”) often occurs on the four basic tones of Mandarin in connected speech. Originated from Sanskrit, the term “sandhi” is defined as “junction, connection, combination or liaison” (Chen, 2000). The most famous tone sandhi involves the third tone though the fourth tone sandhi is often cited as well (Duanmu, 2000):

Third tone (T3) sandhi rules:

1. T3 becomes T2 when it precedes another T3 (e.g. *XI3SHOU3→[xi2shou3]).
2. T3 becomes half-T3 (i.e. Chao's digit 214 becomes 21) when it precedes any tone other than T3 (e.g. *LI3(214)MIAN4→[li3(21)miɛn4]).

**These words/third tone (T3) sandhis are tested in the Malaysian Mandarin (Maldarin) Phonology Test described in Chapter 5.*

From the above tone sandhi rules, we can see that “the third tone never takes on the citation form if there is another tone following it” (Lin, 2001:45).

Fourth tone (T4) sandhi rule:

1. T4 (51) (high falling) becomes T4 (53) (low falling) when it precedes another T4 (51)(high falling)(e.g. SHUI(51)JIAO(51)→ [shui(53)jiɑo(51)]).

3.2.2.2 Variations in Mandarin phonology

As discussed earlier, the Chinese dialects have been broadly divided into seven major groups. Before the rise of Mandarin (Putonghua), many people in China were only able to speak in their own regional dialects. With the promotion of Mandarin (Putonghua) as a lingua franca, speakers of mutually unintelligible dialects were able to communicate with each other. According to a recent survey conducted by the ministry of education in China, more than half of the entire population in China can now speak in Mandarin (Putonghua), and nearly 70% of the urbanites are fluent in Mandarin (Putonghua) (Feng, 2007). However, only a small percentage of the non-Beijing Mandarin (Putonghua) speakers have achieved a similar proficiency level to that of native residents of Beijing. Most non-Beijing Mandarin (Putonghua) speakers are observed to speak Mandarin (Putonghua) with an accent influenced by their regional dialect (Chen, 1999).

Thus far, several extensive studies have been done on local varieties of Mandarin (Putonghua) in China. In general, overall, three common salient phonological features of non-native Beijing Mandarin (Putonghua) are found (Chen, 1999):

1. Deviation of all four basic tones.
2. Lack of contrast between final nasals /n/ and /ŋ/.
3. Lack of contrast between initial alveolars /ts, ts^h, s/ and initial retroflexes /tʂ, tʂ^h, ʂ/.

As there are local varieties of Mandarin (Putonghua) in China, there are local varieties of Mandarin outside China such as Taiwan (Kubler & Ho, 1984; Kubler, 1985), Singapore (Chen, 1983, 1986; Ng, 1985; Lock, 1989) and Malaysia (Yao, 1999; Yew, 1999; Wee, 2002; Lim, 2004) and other Southeast Asia countries.

Chen (1983, 1986), Ng (1985) and Lock (1989) have studied variations of Mandarin in Singapore. Chen (1983, 1986) analysed Singapore Mandarin in the light of interference from the five major local Southern Chinese dialects namely: Hokkien, Teochew, Hainan, Cantonese and Hakka⁵. Yao (1999) and Yew (1999) conducted a follow-up study on variations of Mandarin in Malaysia based on Chen's (1983 & 1986) studies. They compared also the salient phonological features of Malaysian Mandarin to that of Singaporean Mandarin. Historically Malaysian Chinese and Singaporean Chinese shared similar culture and heritage; Singapore was part of Malaysia before 1965 (see Chapter 1). To date, the great majority of the Malaysian Chinese have shared the same five Southern Chinese dialect background with the Singaporean Chinese (see section 3.1). In general, both Yao (1999) and Yew's (1999) studies revealed similar salient phonological features of Malaysian Mandarin to Singaporean Mandarin. Two unusual prominent features were found: 1. the palatal series /tʂi, tʂ^hi, ʂi/ being replaced by the alveolar series [tʂi, tʂ^hi, ʂi], which is not only a non-standard pronunciation but also a violation of Mandarin phonotactics (Chen, 1986); and, 2. the usage of a "short falling pitch" nicknamed the "fifth tone" (T5) (Chen, 1983). These two particular prominent phonological features of Malaysian Mandarin and Singaporean Mandarin were not prominent phonological features in other Southern Chinese dialect speakers of Mandarin elsewhere, such as Taiwan and Hong Kong (Chen, 1983, 1986). In addition, all three studies revealed some reciprocal influences amongst the five local dialects on the pronunciation of Mandarin in Singapore and Malaysia (e.g. HU3→[fu3] originating from the Cantonese dialect was observed in non-Cantonese dialect speaker groups of Mandarin as well) as a result of daily interaction amongst the multi-dialect speakers of Mandarin in the local community. By and large, the findings of all three studies were congruent with recent studies done by Wee (2002) on

⁵ Hokkien, Teochew and Hainan belong to the Min (more specifically "Minnan", literally "Southern Min") dialect group. Cantonese belongs to the "Yue" dialect group, and Hakka belongs to the Hakka ("Kejia") dialect group. In general, Min, Yue and Hakka can be collectively named as the Southern China dialect group (Norman, 1988).

variations of Malaysian Mandarin consonants, and the present analysis of two nursery teachers' pronunciation of Malaysian Mandarin (see section 3.2.2.3 below).

3.2.2.3 Malaysian Mandarin (Maldarin) phonological features

In this section, the description of the salient phonological features of “Malaysian Mandarin”, coined as “Maldarin”, is mainly based on Chen (1983, 1986), Yao (1999), Yew (1999), and the present analysis of the pronunciation of two nursery teachers (see Appendix 4), as well as observation of other Malaysian Chinese speakers' Mandarin pronunciation as a whole. As with Malaysian English (Manglish), the list of phonological variants of Malaysian Mandarin (thereafter MM) can be long when very substandard forms of MM and individual variation forms are taken into account. In general, the phonological features of MM presented here are found in average educated speakers of MM, the examples of which are mainly based on the nursery teachers' pronunciation (see Appendix 4), the baseline for scoring in the main study nursery children subjects' pronunciation test (see Appendix 5 & 6). For ease of comparison across the three languages (Mandarin, English and Malay), the discussion in this section is divided into consonants and vowels and not initials and finals (see Table 3.3 & Figure 3.4 c.f. Figure 3.3). The salient phonological features of MM are summarised below:

Consonants

1. The retroflex affricates and fricative /tʂ, tʂ^h, ʂ/ are often replaced by the alveolar affricates and fricative [ts, ts^h, s]. In one teacher, /tʂ, tʂ^h, ʂ/ are always replaced by [ts, ts^h, s]: ZHAN4→[tsan4], CHI1→[ts^hi1], SHOU3→[sou3]. In another teacher, /tʂ, tʂ^h, ʂ/ are often used inconsistently and interchangeably with [ts, ts^h, s]. For example, ZHAN4→ [tsan4], CHI1→[tʂ^hi1] or [ts^hi1], SHOU3→[ʂou3] or [sou3].
2. The palatal affricates and fricative /tʃ, tʃ^h, ʃ/ are always replaced by the alveolar affricates and fricative [ts, ts^h, s] before the close front unrounded vowel /i/. This is found in both teachers: e.g. JI1→[tsi1], QIAN2→[ts^hien2], XIE2→[sie2].
3. It is commonly reported that the retroflex approximant /ɻ/ has several variants including [l], [n], [dz] and [j] when occurring in different linguistic environments (Chen, 1983; Yao, 1999; Yew, 1999). Generally, /ɻ/ is often replaced by [ɻ], [l], [dz] or [n] inconsistently and interchangeably in words end with a nasal (e.g. RAN2→[ɻan2], [lan2]).

[dzan²], [nan²]). Occasionally, /ɹ/ is replaced by [j] before [ʊŋ] (e.g. RONG²→[jʊŋ²]). In the present study, in one teachers, /ɹ/ is often used inconsistently and interchangeably with the alveolar approximant [ɹ] (e.g. RE⁴→[ɹɣ⁴], [ɹɣ⁴]; ROU⁴→[ɹo^u⁴]). In another teacher, [ɹ] is used interchangeably with [ɹ] and [dz] (ROU⁴→[ɹo^u⁴], [dzɔ^u⁴]).

4. Conversely, the alveolar lateral approximant /l/ is occasionally replaced by [ɹ] (e.g. LUN⁴→[ɹun⁴]), especially in fast speech. However, this does not occur before the close front vowels /i/ and /y/ (Chen, 1986; Yew, 1999).
5. Initial /n/ is occasionally replaced by [l] or vice versa, in words ending with a nasal (e.g. NING²→[liŋ²]; LAN²→[nan²]).
6. The velar fricative /x/ is sometimes replaced by [f], or occasionally by [w] before the close back vowel [u] (e.g. HU³→[fu³]; HUANG²→[wuɑŋ²]) (Chen, 1986; Yao, 1999; Yew, 1999).
7. The final nasal /n/ is often confused with the final nasal /ŋ/. Both /n/ and /ŋ/ are used inconsistently and interchangeably especially after vowels /i, ə/. The most common confusions are /in/ being replaced by [iŋ] (e.g. JIN⁴→[tʃiŋ⁴]), and /ʌŋ/(or /əŋ/)(see next section) being replaced by [ən] (e.g. LENG³→[lən³]) (Chen, 1983; Yao, 1999; Yew, 1999).

Vowels

1. The close front rounded vowel /y/ is often used inconsistently and interchangeably with the close front unrounded vowel /i/. In both teachers for instance, both standard and non-standard realisations of /y/ are observed (e.g. YUE⁴→[yɛ⁴], [iɛ⁴], NÜ³→[ny³], [ni³]).
2. The final /uo/ is often realized as [^uo] or [o] with the medial weakened or omitted; or occasionally with a further lowering of the main vowel for the later as [ɔ]. In addition, occasionally, only the main vowel is lowered as [uɑ]. In one teacher, /uo/ is usually realized as [^uo] (e.g. ZUO⁴→[ts^uo⁴], ZHUO¹→[ts^uo¹]).

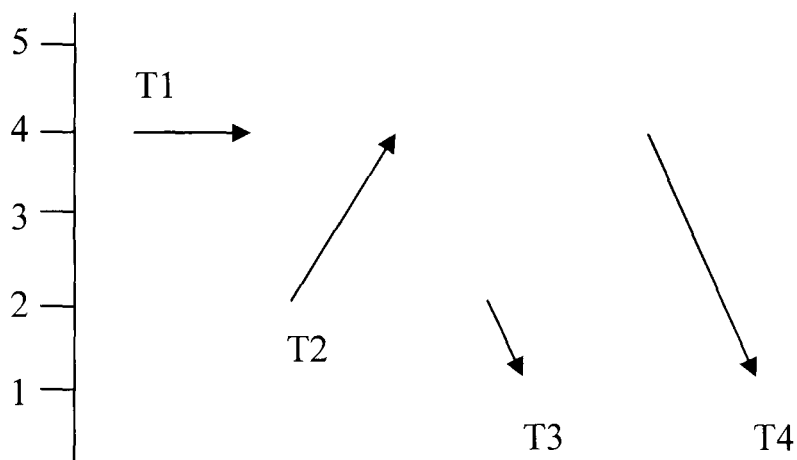
3. The final /ei/ is sometimes realised as [eⁱ] or [e] with the ending weakened or omitted; or with a further lowering of the main vowel for both as [ɛⁱ] or [ɛ]. In both teachers, /ei/ is realised as [eⁱ] (e.g. FEI1JI1 → [feⁱ1ji1]).
4. The final /ueɪ/ is often realized as [ui] or [ue] with the main vowel raised and the ending weakened or with the ending omitted only. In one teacher, /ueɪ/ is used inconsistently and interchangeably with /ui/ (e.g. ZUI3 → [tsueɪ3]; SHUI4 → [sui4]). In another teacher, /ueɪ/ is always replaced by [ui] (e.g. ZUI3 → [tsui3], SHUI4 → [sui4]).
5. The final /ou/ is often realised as [o^u] or [o] with the ending weakened or omitted. Sometimes, in addition to weakening and omitting of the endings, lowering of the main vowel is also occurred, and hence [ɔ^u] or [ɔ]. In one teacher, /ou/ is used inconsistently and interchangeably with /o^u/ and /ɔ^u/ (e.g. SHOU3 → [sou3], [sɔ^u3]; GOU3 → [ko^u3]; TOU2 → [t^ho^u2]).
6. The final /iou/ is most often realised as [iu] or [io] in all tones with the main vowel raised and the ending omitted or with the ending omitted only. In one teacher for instance, /iou/ is realised as [iu] (e.g. LIU4 → [liu4]).
7. The final /ɛŋ/ is always realized as [ɛŋ] with the main vowel raised and fronted (e.g. DENG1 → [tɛŋ1]).
8. The main vowel in finals /uŋ/ and /iouŋ/ is often lowered to [oŋ] and [ioŋ]. The following example is found in both teachers' pronunciation (e.g. CHONG1LIANG2 → [ts^hoŋ1liɑŋ2]).
9. The suffix-r /ʂ/ in rhotacisation is rarely used. /ʂ/ in isolation is always realised as [ə] (e.g. ER3 → [ə3]).

Tones

The description of MM tones in this section is mainly based on Chen (1983). In general, the salient tonal features of MM are summarised below:

1. Deviation of pitch contours of all four tones in Mandarin (see Figure 3.6). As with the case of Singaporean Mandarin, all four tones in MM appear to be “lower” than that of Mandarin (Putonghua) (c.f. Figure 3.5 in section 3.2.2.1)(Chen, 1983):

Figure 3.6: The four tones of Malaysian Mandarin (Maldarin)



- a. T1 (55) is always realised as 44. The following example is taken from the teachers' tonal production: KU1 → [k^hu(44)].
- b. T2 (35) is always realised as 24. The following example is taken from the teachers' tonal production: TOU2 → [t^hou(24)].
- c. T3 (214) is always realised as 21 even in final position⁶. The following example is taken from the teachers' tonal production: YA2CHI3 → [i_a2tʂi_i(21)].
- d. T4 (51) is often realised as 41. The following example is taken from the teachers' tonal production: RE4 → [ʒɤ(41)].

⁶ Third tone in Mandarin often encounters tone changes (see section 3.2.2.1).

2. Use of a short-falling pitch:

Overall, the MM tones are not only “lower”, but are also “shorter” in duration, and more “tensed” than that of Mandarin (Putonghua). This short-falling pitch, nicknamed the Fifth Tone (T5) was reported for Singaporean Mandarin (Chen, 1983) on especially T1, T2 and T3 characters. The Southern Chinese dialects Medieval Chinese characters bearing “ru sheng” (literally “entering tone”)(i.e. characters end in a stop /p, t, k/) are said to be the source for this short-falling pitch. Yao (1999) and Yew (1999) in their studies on MM tones also reported the presence of this short-falling pitch.

3. Neutral tone (T0) is used much less frequently. In the present study, in both teachers for instance, words with affix-*zi* [tsɿ3] are all pronounced without the neutral tone (e.g. xie2zi0→[ɕiɛ2tsɿ3]). Likewise, the reduplicated verb is also pronounced without the neutral tone (e.g. HUA4HUA0→[xuɚ4xuɚ4]). Neutral tone is only used on the two reduplicated nouns (kinship terms) namely: MA1MA0 and DI4DI0.

4. Other miscellaneous lexical tonal errors are also frequently observed in MM. The following example is taken from the teachers’ tonal data (e.g. KU1→[k^hu4]).

5. Deviation of tone sandhi rules following deviation of pitch contour of all four basic tones is observed:

a. Of all three sandhi rules namely: two for the third tone, and one for the fourth tone (see section 3.2.2.1), only the first third tone sandhi rule namely: “T3 becomes T2 when it precedes another T3” can be concluded with confidence. In both teachers for instance, the following first third tone sandhi rule is observed (e.g. XI3SHOU3→[ɕi2ʂou3]).

b. The presence of the second third tone sandhi rule namely: “T3 becomes half-T3 (i.e. Chao’s (1930 & 1968)) digit 214 becomes 21 when it precedes any tone other than T3” is doubtful. This is because T3 in itself is often realised as a half-T3 (21) even in final position (see above 1c). In both teachers for instance, the potential second third tone sandhi is observed (e.g. LI3MIAN4→[li(21) miɛn4]). Nevertheless since LI3 in itself is often realised as 21, it cannot be assumed with confidence that such changes of pitch from 214 to 21 is a result of influence from the subsequent T4.

- c. Likewise, the presence of the fourth tone sandhi rule namely: “T4 (51) (high falling) becomes T4 (53) (low falling) when it precedes another T4 (51)(high falling)” is also doubtful. This is because T4 in itself is often realised as 41 (low falling in the similar sense) in final position (see above 1d). In both teachers for instance, the fourth tone sandhi is deviated due to the deviation of pitch of T4 itself (e.g. SHUI4JIAO4→[ʃueɪ(41)tɕiɑo(41)]).

3.2.3 The Malay language

The Malay language belongs to the Austronesian language family (Clark, 1987; Ruhlen, 1987). Five countries in the Southeast Asia, namely Indonesia, Malaysia, Singapore, Brunei and East Timor, are collectively named as the “core of the Malay region” (Gupta, 2003). Figure 3.7 represents the map for this Malay region:

Figure 3.7: The core of the Malay region



Source: http://www.atlapedia.com/online/maps/physical/Malaysia_etc.htm.

The Malay language is one of the 13 major world languages, with about 47 million native speakers (Grimes, 1996). Historically, the Malay language was used as the lingua franca in the cosmopolitan trading centers of the Malay region (Gupta, 2003). It is now used as an official language in Malaysia, Brunei and Singapore, as well as a working language in East Timor (Wikipedia Encyclopedia, 2005b).

3.2.3.1 Malay

In Malaysia, the Malay language called “Bahasa Malaysia” (literally “Malaysian language”) is the largest spoken language in the country. Due to regional factors, there exist many dialects or varieties of Malay for instance, “Johor Malay”, “Kedah Malay”, “Perak Malay”.

The “Standard Malay” based on the “Johor-Riau Malay” dialect is a prestige dialect used as the norm for the Malay language in Malaysia. It is widely used in the mass media and school (Teoh, 1994; Nik Safiah, Farid, Hashim & Abdul Hamid, 1997). It is close to “Literary Malay” particularly in morphological and syntactic aspects (Farid, 1980), though some differences are found between the two (Zaharani, 1998):

1. Orthographic “a” in word-final position is realised as an open front vowel [a] in Literary Malay (e.g. TIGA→[tiga]), but it is realised as a schwa [ə] in Standard Malay (e.g. TIGA→[tigə])(hence the “Schwa Variety”).
2. Orthographic “r” in word-initial and inter-vocalic positions is realised as an alveolar flap [ɾ] in Literary Malay (e.g. RUMAH→[rumah], LORI→[lori]), but it is commonly realised as a voiced velar fricative [ɣ] in Standard Malay (e.g. RUMAH→[ɣumah], LORI→[loyi]). In syllable-final position, orthographic “r” is never realised in Standard Malay (e.g. BESAR→[bəsa]), but it is always realised in Literary Malay (e.g. BESAR→[bəsaɾ])(see further discussion in section 3.2.3.2).
3. Orthographic “i, u” in word-final closed-syllable position are realised as close-mid vowels [e, o] in Standard Malay (e.g. KUCING→[kutʃeŋ], PULUH→[puloh]), but they are retained as close vowels in Literary Malay (e.g. KUCING→[kutʃiŋ], PULUH→[puh]).

“Dewan Bahasa dan Pustaka” (literally “Government’s Language Planning Agency”) has enforced the usage of “Sebutan Baku Bahasa Melayu” (literally “the standard pronunciation of Malay”) which is based on Literary Malay: all words are pronounced based on the orthographic presentation: e.g. TIGA→[tiga] not [tigə]. Nevertheless the “Schwa Variety” is still considered as the most representative contemporary Standard Malay (thereafter “Malay”) pronunciation (Zaharani, 1998).

Like the English language, Malay has adopted a phonographic writing system (namely the Roman alphabetical letters) as its standard written form. Malay contains many loan words from foreign languages such as Arabic (especially religious terms) and English. Examples of loan words from English are: JEM (JAM), EPEL (APPLE), YOYO (YOYO), BAS (BUS), LORI (LORRY).

Malay is a derivative or agglutinative language in which word meaning can be changed by attachment of prefix or suffix (see further discussion in section 3.2.3.2). For example, the meaning of the simple word (verb) NYANYI (TO SING) changed when prefixes or suffixes are attached to it:

1. MENYANYI (SINGS, IS SINGING)
2. DINYANYI (SUNG-PASSIVE)
3. PENYANYI (SINGER-PERSON)
4. NYANYIAN (SONG)

3.2.3.2 Malay phonology

There has been an upsurge in the study of Malay phonology since the 1970s⁷. Most of these studies have focused on the description of the regional Malay dialectal phonologies such as the Kedah and Kelantan dialects. In general, amongst the most frequently cited Malay phonology works are studies done by Yunus (1980), Farid (1980) and Teoh (1994). In this section, an overview of Malay phonology will be given, the description of which is mainly based on Yunus (1980). As with the description of the phonology of Mandarin, some aspects of Malay phonetics are discussed as and when the illustration of certain aspects of Malay sound system is required.

⁷ See Teoh (1994) for a review of research on Malay phonology.

Syllables and word structures

The basic syllable structure in Malay is (C)V(C). There are no consonant clusters in Malay syllables. There are four types of words in Malay, namely: simple words, derived words, complex words and compound words (Nik Safiah et al., 1997).

There are very few simple monosyllabic words in Malay, only about twenty, available in two syllable structures: CV (e.g. YA) and CVC (e.g. BAS). The majority of the Malay simple words are disyllabic made up of nine syllable structures (see Table 3.4):

Table 3.4: The nine disyllabic structures of Malay

Disyllable structure	Word in Malay	IPA	Meaning
V-VC	*AIB	[aeb]	strange
V-CV	IBU	[ibu]	mother
V-CVC	AYAM	[ajam]	chicken
VC-CV	*UNTA	[untə]	camel
VC-CVC	*ANGKAT	[aŋkat]	Dog
CV-V	*TUA	[tuə]	s/he
CV-VC	DAUN	[daun]	Leaf
CV-CV	GIGI	[gigi]	Teeth
CV-CVC	MULUT	[mūlut]	mouth

**Except for AEB, UNTA, ANGKAT, TUA which are not familiar to the children below the age of four years in the present study, the above disyllabic words are tested in the Chinese Malay (ChinMalay) Phonology Test described in Chapter 5.*

Trisyllabic simple words are much rarer. Most of them are loan words made up of eighteen syllable structures, for example, V-CV-CV (e.g. INGERIS). Four or more syllable simple words are even rarer. Most of them are loan words, for example, CV-CV-CV-CV (e.g. FONOLOGI).

The derived words in Malay may contain a long string of syllables as a result of affixation and reduplication processes. For example, CV-CV-VC-CV-CV-VC (e.g. NYANYIAN-NYANYIAN) (see section 3.2.3.1). It is noteworthy that these derived words are not commonly used in spoken Malay. Spoken Malay commonly consists of simple sentences that are made up of reduced words (e.g. TIDAK → [tak], ABANG → [bang]) (Nik Safiah et al., 1997).

Consonants

The consonants of Malay can be broadly divided into two types namely: primary consonants (native consonants) and secondary consonants (loan consonants). As mentioned earlier, there are no consonant clusters in Malay. There are nineteen primary consonants in Malay (see Table 3.5).

Table 3.5: The primary consonants of Malay

	Bilabial	Alveolar	Post-alveolar	Palatal	Velar	Glottal
Plosive	p b	t d			k g	ʔ
Nasal	m	n	ɲ		ŋ	
Affricate			tʃ dʒ			
Fricative		s				h
Trill		r				
Approximant	w			j		
Lateral approximant		l				

Source: adapted from Yunus (1980:52).

There are seven plosives in Malay: six oral plosives and one glottal stop. All six oral plosives are unreleased in word final position (e.g. ASAP, ARNAB, MULUT, WUJUD, CANTIK, BEG). Unlike English, /p, t, k/ in Malay are always unaspirated. In the orthography, /ʔ/ is annotated as “k” in the inter-vocalic and post-vocalic positions (e.g. YAKNI [jaʔni], NENEK [neneʔ]). There are two fricatives in Malay: /s, h/. Some speakers omit the /h/ or replace it with [ʔ] in word initial pre-vocalic position (e.g. HUJAN→[udʒan], [ʔudʒan]). The voiceless and voiced post-alveolar affricates /tʃ/ and /dʒ/ do not occur in word final post-vocalic position, except in a few loan words (e.g. JALAN BIRCH [jalan bətʃ], KOLEJ [kolədʒ]). For the alveolar trill /r/, the extent to which the tongue-tip is fluttered against the teeth-ridge varies from one speaker to another- some flutter less, others flutter more; nevertheless it is rarely fluttered in word final position (e.g. BESAR→[bəsa]). On the other hand, it is always realised in inter-vocalic position. As a variant of alveolar-trill /r/, the voiced velar fricative [ɣ] is commonly used in Malay (see section 3.2.3.1). Of the four nasals in Malay: /m, n, ɲ, ŋ/, the post-alveolar nasal /ɲ/ does not occur in word final position. The two approximants /w, j/ do not occur in syllable-final or word final positions.

Secondary consonants

Yunus (1980) mentioned that the Malay secondary consonants are loan consonants that have been brought into the language through the presence of loan words, particularly from the Arabic language. Historically there were more loan consonants, but later some of them were assimilated into the Malay sound system or became variants of Malay consonants. Now, there are eight secondary consonants left in Malay as shown in Table 3.6, all of which are fricatives. All of these loan sounds are of Arabic origin except for /v/ which is of English origin:

Table 3.6: The secondary consonants of Malay

	Labio-dental	Dental	Alveolar	Post-alveolar	Velar
Fricative	f v	θ ð	z	ʃ	x ɣ

Source: adapted from Yunus (1980:88).

Many Malay speakers replace these loan consonants with primary consonants which are close to them phonetically. For example, /f/ is sometimes replaced by [p] e.g. FAHAM → [paham]. Likewise /θ/ is commonly replaced by [s], [ð], or [d]; and [dʒ] by [z]. /v/ is hardly used, it is only found in word-initial pre-vocalic and within-word inter-vocalic positions (e.g. VAN [van], NOVEL [novəl]). The post-alveolar fricative /ʃ/ is annotated as “sy” in the orthography, and the velar fricatives /x/ and /ɣ/, “kh” and “gh” respectively.

Stress

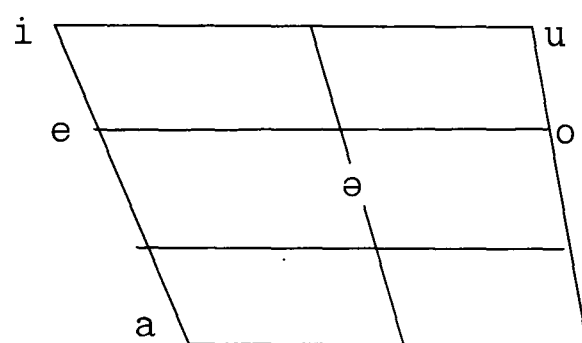
The prosody of Malay including word stress is an under-explored area. Malay is a syllable-timed language (Wang, 1987; Sajlia & Rickard Liow, 2008). The discussion on Malay word stress in this section is mainly based on Ramish (1969) and Tajul Aripin (2000). Stress in Malay is defined as increased articulatory force or loudness. Unlike English, the differences between varying degrees of stress in Malay are small. The syllable carrying the primary stress is realised only slightly louder than the syllable carrying the secondary stress.

In both disyllabic words and polysyllabic words, primary stress generally occurs on the second syllable from the right (the penultimate syllable) (e.g. MULUT ['mũlut], TELINGA [tə'liŋə]). If the vowel of the penultimate syllable of a disyllabic word is a schwa /ə/, stress is shifted to the final syllable (e.g. EMPAT [əm'pat]), whereas in polysyllabic words, stress is shifted to the antepenultimate syllable (e.g. TENTERA ['təntərə]). In general, an initial “secondary stress” is observed to occur on the leftmost syllable (first syllable) in polysyllabic words of four or more syllable (e.g. MATAHARI [,mata'hari]).

Vowels

There are six monophthongs in Malay (see Figure 3.8):

Figure 3.8: The monophthongs of Malay



Source: Yunus (1980:2)

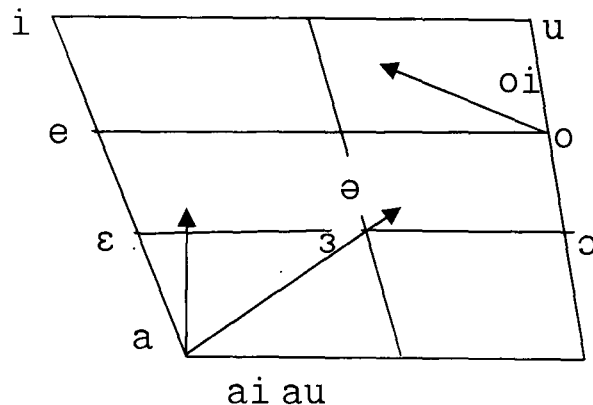
In general, vowel/s occurring after a nasal consonant are nasalized (e.g. MULUT → [mũlut]). Vowels are generally realised with similar length; vowel length bears no semantic differences in Malay. Vowel distribution is affected by both syllable structure (open or closed) and syllable position (word initial, word medial and word final) (Teoh, 1994). In general, in simple disyllabic words, vowels occur in all three word positions except for [e, a, o] in word final open-syllable position, and [i, u, ə] in word final closed-syllable position⁸ (see section 3.2.3.1).

⁸See exception to these rules in Yunus (1980).

Diphthongs

There are three diphthongs in Malay: /ai, au and oi/ (see Figure 3.9). The diphthong /oi/ only occurs in word final position in a handful of words:

Figure 3.9: The diphthongs of Malay



Source: Yunus (1980:43).

Vowel Sequences

The term “vowel sequence” refers to the occurrence of two or more consecutive vowels belonging to separate syllables. Examples of some possible vowel sequences in Malay are given below:

- 1) Two vowels with the second vowel in open or closed-syllable position: /ia, iu, io, iə, au, ao, ai, ae, ui, ue, ua, uə/ (e.g. DAUN).
- 2) One vowel followed by a diphthong: /iai, iau, uai, uau/ (e.g. BUAI).
- 3) One vowel followed by a diphthong as above, further followed by a vowel e.g. suffix *-i* or *-an* i.e. /iaua, uaii, uaia/ (e.g. BUAIAN).

3.2.3.3 Variations in Malay phonology

There has not yet been any substantial research done on Chinese Malay pronunciation. Though there have been some local studies on error-analysis of second-language learning of Malay by Malaysian Chinese students at primary school and secondary school, these studies mostly focused on overall language command of Malay with regards to morphology, syntax and phonology. Moreover, these studies consisted of small-scale research conducted by the final year students as their academic exercise (thesis) project in the local universities in Malaysia (e.g. Lee, 1995; Norizan, 1995). Other studies on Chinese Malay concentrated on overall communication skills in Malay (e.g. Ang, 1992; Halimah & Noor Aina, 2002). Elsewhere, the Chinese speaker’s non-standard

pronunciation of certain Malay consonants has sometimes been alluded to in the description of Malay phonology and phonetics but was not research-based (e.g. Abdul Aziz, 1988). Hence, the discussion in this section is mainly based on the analysis of the pronunciation of two nursery teachers in the present study, and the subjective observation of other Malaysian Chinese speakers' pronunciation of Malay. Generally nursery teachers are claimed to be one of the most important sources for Malay language learning in young Malaysian Chinese children, and Malaysian Chinese children normally start learning Malay from nursery onwards (see Chapter 5). As with Malaysian English (Manglish) and Malaysian Mandarin (Maldarin), the list of phonological variants of Chinese Malay, coined as "ChinMalay" (thereafter CM)(see section 3.2.3.4 below) can be long when very sub-standard forms of CM alongside individual variations of CM are taken into account. In general, both standard and non-standard realisations of CM presented in the following section are commonly found in average educated speakers of CM. The examples of both informal realisational forms of CM used outside the classroom and more formal realisational forms of CM used in the classroom presented here are largely based on the nursery teachers' pronunciation, the benchmark for scoring in the main study (see Appendix 4). Further study based on a larger sample is desired in order to establish a more comprehensive picture of the CM pronunciation but this falls beyond the scope of the present study.

3.2.3.4 Chinese Malay (ChinMalay) phonological features

Based on the analysis of the pronunciation of two teachers in the present study (see Appendix 4) plus the subjective observation of other Malaysian Chinese speakers' pronunciation of Malay, a brief qualitative description of the salient phonological features of Chinese Malay (ChinMalay) is given below:

Consonants

1. The alveolar trill /r/ has variable realizations. It is sometimes realised as a weak trill [r], an alveolar approximant [ɹ], an alveolar tap [ɾ], or an alveolar lateral approximant [l] in both word initial and word medial positions. The commonly used variant for /r/ i.e. voiced velar fricative [ʁ] in Malay mentioned earlier (see section 3.2.3.1) is not commonly used by Malaysian Chinese speakers. In the present study one teacher used [r] inconsistently and interchangeably with alveolar approximant [ɹ]: RUMAH→[ruma], ROTI→[ɹoti], LORI→[lori], [lɔɹi]. In another teacher, [r] is used inconsistently and interchangeably with [ɾ]: ROTI→[rɔʔti], RUMAH→[ruma], LORI →[lɔɾi].

2. The alveolar lateral approximant /l/ is often omitted in word final position. In one teacher, final /l/ is always omitted (e.g. EPAL→[epə], PENSEL→[pense]). In another teacher, final /l/ is sometimes omitted (e.g. EPAL→[epəl], PENSEL→[pense]).
3. The glottal fricative /h/ is always omitted in word final position. This is found in both teachers' pronunciation (e.g. RUMAH→[ɽuma]). Unlike some native speakers of Malay mentioned earlier (see section 3.2.3.2), /h/ is always preserved in word initial pre-vocalic position in both teachers (e.g. HUJAN→[hudʒan]).
4. The bilabial plosive /p/ is sometimes aspirated, especially in loan words from English. This is observed in one teacher (PENSEL→[p^hensə]).

Vowels

1. The close-mid back vowel /o/ is often replaced by the open-mid back vowel [ɔ] notably after the alveolar trill /r/ and the alveolar lateral approximant /l/ in casual speech. This is also commonly observed in the native Malay speakers. In one teacher however, /o/ is always retained (e.g. ROTI→[ɽoti]), LORI→[loɽi]). In another teacher, /o/ is always replaced by [ɔ] (e.g. ROTI→[rɔʔti], LORI→[lɔri]). Nevertheless, /o/ is retained in English loan words i.e. YOYO in both teachers (e.g. YOYO→[jojo]).
2. The insertion of glottal stop [ʔ] after /o/ in the target word ROTI which is more lexically based is sometimes observed in the speech of some Malaysian Chinese speakers. This is also observed in the speech of one teacher (ROTI→[rɔʔti]).
3. Literary Malay vowels are occasionally used (see section 3.2.3.1). The following examples are taken from the teachers' speech data (e.g. KUCING→[kutʃiŋ], MEJA→[medʒa]). Nevertheless, Malay vowels notably schwa /ə/, are retained in loan words from English in both teachers (e.g. EPAL→[epə], PENSEL→[p^hensə]).

3.3 CONCLUSION

Due to the complex multiracial/multilingual background, the Chinese in Malaysia are facing multilingual challenges. Their three major languages namely: English, Mandarin and Malay are subject to historical dialectal influences as well as other local language influences, giving birth to the present local varieties of the languages namely: Malaysian English (Manglish), Malaysian Mandarin (Maldarin) and Chinese Malay (ChinMalay). The local phonological variants exhibited by these three local varieties of languages ought to be addressed in multilingual phonological acquisition study in order to avoid misinterpreting local adult phonological variants as developmental patterns used by the children. In the light of the paucity of accent studies in the three local languages spoken by the ethnic Chinese, the present study set out to examine two nursery teachers' pronunciation in the three languages. This analysis was based on their naming responses to the test battery that was devised for the phonological development study reported in this thesis. These teachers' phonological variants, together with the prominent phonological features commonly cited in the local literature provide the benchmark for scoring the children's phonological production. This novel approach is adopted in the present study in order to take account of the potential influence of local adult pronunciation patterns on multilingual phonological development.

CHAPTER 4

PHONOLOGICAL DEVELOPMENT IN MALAYSIAN CHILDREN

4.0 INTRODUCTION

As alluded to in Chapter 1, there is not yet any substantial research on the acquisition of phonology in Malaysian children. Nevertheless the last decade has seen an upsurge in the study of child phonology in the country following the establishment of the first academic undergraduate degree “Speech Sciences” programme in the National University of Malaysia (Universiti Kebangsaan Malaysia) at the capital Kuala Lumpur. The studies have mostly consisted of small-scale research conducted by final year students as their academic exercise (thesis) project; and by the lecturers as part of their university-funded research or their own post-graduate studies. An overview of these studies is given below.

4.1 PHONOLOGICAL DEVELOPMENT STUDIES OF MALAYSIAN CHILDREN

The majority of the above-mentioned child phonology studies have focused on typically-developing children. Only two studies were done on non-typically developing children (Rasyikah, 2001; Ahmad Mustaffa, 2002). Studies on the normal population have concentrated on the three major ethnic groups (i.e. Malay, Chinese and Indian) in the country and three of the four basic local languages- Malay, Mandarin and English but not Tamil, plus Cantonese, as described below.

4.2 MONOLINGUAL PHONOLOGICAL DEVELOPMENT STUDIES

4.2.1 Phonological development in Malay

Four studies have been done on phonological acquisition in Malay among Malay children (Kartini, 1991; Nor Azizah, 1999; Badrulzaman, Lim & Sandra, 1999; Norhaizan, 2005). With the exception of the study done by Badrulzaman et al. (1999), all these studies recruited a small number of Malay pre-school children within a small age band i.e. four 2;04-4;00 subjects (Kartini, 1991), ten 4;00-4;06 subjects (Nor Azizah, 1999) and nine 3;06-3;11 subjects (Norhaizan, 2005). Badrulzaman et al. (1999) used 40 subjects aged between 2;00 and 5;11. The children in these studies all used Malay as their first or dominant language, and all lived in the region of Kuala Lumpur-Selangor i.e. in and around the capital of Malaysia. All except one study (Kartini, 1991) collected the sample data locally.

With the exception of the case study done by Kartini (1991), all these studies adopted a small-scale descriptive cross-sectional study approach. Generally the aims of these studies were to identify the age of “consonantal acquisition” in the subjects by focusing on consonant error patterns or phonological process error analysis. Except for the study done by Norhaizan (2005), all studies concentrated only on “primary Malay consonants” and excluded the “secondary Malay consonants” (see Chapter 3).

To sum up, generally /r, s/ (primary consonants) and /f, v, z/ (secondary consonants) have been reported as the late acquired consonants by these studies. Table 4.1 provides an overview of primary consonant development in Malay based on these studies:

Table 4.1: Age of acquisition for consonants in Malay

Age	Consonant
2;00-2;11	j, w, m, n, ŋ, p, t, g, ʔ, b, d, k, ŋ, tʃ, dʒ
3;00-3;11	h, l
4;00 & above	s, r

The major consonant simplifications reported by these studies are: fronting, stopping, glottal replacement, backing, affrication, gliding and deletion, while the minor ones are /r/→[l] substitution, addition, metathesis and consonant harmony. In general, consonant simplifications were reported to decline with age.

These studies have contributed some useful preliminary information to the field of Malay child phonology. However, as the subject samples employed were rather small, the results need to be interpreted with caution. In addition, most of the age bands under study were rather narrow: all except one study were less than one year. As a result, the sequence of consonantal acquisition across the pre-school age range has not been demonstrated. Also, most of these studies have adopted poor “age of phoneme acquisition criteria”, therefore at what age a particular consonant was considered as “acquired” in the subjects had not been made very clear. This is crucial in a study of this kind. Moreover, these studies have only concentrated on consonant acquisition, other major linguistic aspects such as vowel, syllable structure and consistency of word production were all neglected. Another shortcoming of these studies was the exclusion of the analysis of subject’s sound production in the light of their second language or home dialects. In reality, the subjects in these studies were not “monolingual”, they were learning English in the nurseries, and even the youngest subjects who had not started their nurseries were “receptive bilingual” of English due to their exposure to the multilingual environment (see Chapter 5).

4.2.2 Phonological development in English

Two studies have been done on phonological acquisition in English among Malaysian children. One was on Chinese children (Ng, 1999) and the other was on Indian children (Pamela, 2000). As with the studies described above, both studies also adopted a small-scale descriptive cross-sectional study approach. Both studies recruited five subjects only. Ng (1999) studied children aged between 2;06-4;00 and Pamela (2000) studied children aged between 2;00-6:00.

Generally the aims of these studies were also to identify the age of consonantal acquisition in the subjects by focusing on consonant error analysis. Both studies briefly described Malaysian English accent called “Manglish” (see Chapter 3), they compared the subjects’ consonant error patterns (simplifications) with two additional adults (Ng, 1999), and the mother of the subjects (Pamela, 2000) respectively. A consonant error pattern was considered only if it did not appear in the adult’s phonological system.

/v, θ, ð, (z)/ were reported as late acquired consonants. Both studies discussed the influence of adult speakers on the production of these consonants. Pamela (2000) for instance acknowledged the inconsistent usage of /θ, ð/ in the mothers themselves in a spontaneous speech task, /θ/ tended to be realized as [t] and /ð/ tended to be realized as [d], whereas in a single word naming task, /θ, ð/ were preserved. Common consonant simplifications reported by these studies were final consonant deletion, consonant cluster reduction, stopping, gliding of liquids, gliding of fricatives and alveolar assimilation.

Both studies can be commended for their consideration of the local adult English accent. However, as with the above studies on Malay phonological acquisition, these studies used a very small number of subjects, focused only on the consonantal aspect of phonological acquisition, excluded the analysis of the child’s second language phonological acquisition, and neglected to state clear age of phoneme acquisition criteria. These limitations mean that the results have to be interpreted with some caution.

Table 4.2 illustrates English phonological development in Malaysian children and its comparison with native English-speaking children in England (Dodd, Holm, Zhu & Crosbie, 2003)(see also Chapter 2):

Table 4.2: Age of acquisition for consonants in English

Age	Ng (1999)	Pamela (2000)	Dodd et al. (2003)
2;00-2;11	p, b, t, d, k, g, h m, n, ŋ f, s, ʃ tʃ, dʒ l, w ʒ-not tested	p, b, t, d, k, g, h m, n, ŋ f, s, ʃ tʃ, dʒ l, j	-nil
3;00-3;11	z, j, r	s, z, r	p, b, t, d, k, g m, n, ŋ f, v, s, z, h w, -l, j tʃ
4;00-4;11	-nil	w	ʒ dʒ
5;00-5;11	-nil	-	ʃ
6;00-6;11	-nil	-	ɹ
7;00 & above	-nil	-nil	θ, ð

Table 4.2 suggests that some consonants, such as /tʃ, dʒ, ʃ/, are acquired earlier by Malaysian children than by British-speaking children. However, because of the methodological limitations of the Malaysian studies discussed above, this conclusion needs to be treated with considerable caution.

4.2.3 Phonological development in Mandarin

Two studies have been conducted on phonological acquisition in Mandarin by ethnic Chinese children in Malaysia. Lim (2002) studied 100 pre-school children aged between 2;00-4;06, while Oo (2001) studied 10 children aged between 2;00-6;11.

Oo (2001) concentrated only on consonantal aspects of phonological acquisition. Other important aspects of Mandarin phonology such as tone and vowel were excluded. She used a small-scale descriptive cross-sectional study approach. In general the aims of her study were to identify consonant inventories and consonant error patterns. She compared the child's consonant inventory and consonant error patterns with his/her mother's. A consonant error pattern (simplification) was only considered if it did not appear in the adult system. She reported some variants in the mother's consonantal production notably the

following substitutions: /l/→[n], /ɹ/→[l], /tʂ/→[ts], /tʂʰ/→[tsʰ], /ʂ/→[s] which, except for /l/, according to Oo was the reason for late acquisition of these consonants by the child. /r/ emerged surprisingly early in one of the 2 year-old subjects but was found more obviously from 5 year-old and onwards. She identified three major consonant simplifications in the subjects namely: /l/→[n] substitution, fronting /ʂ/→[s], and /ɹ/→[l] substitution which she acknowledged were a result of adult pronunciation influence.

As the local Mandarin accent is an under-explored area, her study of the adult pronunciation has shed light on this area. However, her study used a small sample and did not clearly define age of phoneme acquisition criteria, thus her findings require further confirmation by future research.

Lim (2002) used a large-scale cross-sectional study approach of 100 children aged between 2;00 and 4;06. She reported tones being the earliest acquired phonological component, followed by final consonants /n, ŋ/ and vowels, and lastly initial consonants. She reported that /tʂʰ, ʂ, ɹ/ were late acquired consonants. She also identified the following consonant error patterns (simplifications) in the subjects: consonant harmony, stopping, initial consonant deletion, affrication, (de)aspiration, backing, fronting and gliding. Although she used a larger sample size and adopted clear age of phoneme acquisition criteria, the scoring criteria were not defined clearly because the adult input model was not considered sufficiently. As described in Chapter 3, the multiracial/multilingual situation in Malaysia means that the potential influence of local dialects is great. This needs to be taken into consideration when deciding what is correct or an error production for a particular target consonant.

Table 4.3 provides an overview of Mandarin phonological development in Malaysian children compared to Mandarin/Putonghua-speaking children in China (Zhu & Dodd, 2000)(see also Chapter 2):

Table 4.3: Age of acquisition for consonants in Mandarin

Age	Oo (2001)	Lim (2002)	Zhu & Dodd (2000)
2;01-2;06	Nil	p, p ^h , k, k ^h , m, tɕ, tɕ ^h , n, ts ^h , t ^h , x -n, -ŋ tones vowels	t, t ^h , k, m, n, x, tɕ, tɕ ^h , ɕ, f, s, tʂ -n, -ŋ tones vowels
2;07-3;00	t, t ^h , k, m, n, x, tɕ, tɕ ^h , ɕ, f, s, p, l, p ^h , k ^h , ts, ts ^h , ɹ -n, -ŋ vowels not tested tones not tested	t, f, s, ts, l	p, l
3;01-3;06	-	ɕ, tʂ ^h , ʂ	p ^h , k ^h , tʂ ^h
3;07-4;00	-	-	ʂ
4;01-4;06	-	ɹ	ts, ts ^h , ɹ
4;07-5;00	tʂ	Nil	Nil
5;01-5;06	-	Nil	Nil
5;07-6;00	-	Nil	Nil
6;01-6;06	-	Nil	Nil
6;07-7;00	tʂ ^h , ʂ	Nil	Nil

Table 4.3 shows that compared to the other consonants, /tʂ, tʂ^h, ʂ, ɹ/ tend to be acquired late by both populations of children acquiring Mandarin. There is more consensus on the age of acquisition for the early acquired consonants than the late acquired consonants /tʂ, tʂ^h, ʂ, ɹ/. However, because of the inexplicit scoring criteria employed in the Malaysian studies by Oo (2001) and Lim (2002), in which the adult input model was not sufficiently taken into account, this comparison of Malaysian Mandarin phonological development with the previous findings relating to Putonghua has to be treated with caution. Further research into Malaysian Mandarin phonological acquisition utilizing a more sophisticated methodology is needed.

4.2.4 Phonological development in Cantonese

One study has been done on a local dialect other than the three major languages mentioned above. Yoon (2001) conducted a small-scale descriptive cross-sectional study on Cantonese, a Southern Chinese dialect, among Cantonese-speaking children in Malaysia (see Chapter 3). He studied ten children aged between 2;00 and 6;00. He also concentrated only on consonantal acquisition in the subjects and the consonant error patterns (simplifications) exhibited by them. The mother's consonant inventory was also compared with the child's.

Yoon (2001) reported early acquisition of the Cantonese consonants in his subjects. According to him, all consonants have been acquired by the age of 3;00, the latest acquired consonant being /k^hw/. The major consonant simplifications exhibited by the subjects were: backing, stopping, deaspiration, (de)affrication, gliding, initial consonant deletion, final consonant deletion, consonant cluster deletion and assimilation. Typical consonant simplifications in Cantonese (So & Dodd, 1995) such as: /l/→[n] substitution, /n/→[l] substitution, initial consonant deletion /ŋ/→[∅] were noted. In addition, atypical error patterns i.e. /w-insertion/ (e.g. PING2GUO2→ [p^hiŋ^hkwɔ2]) due to the influence of Mandarin has also been observed. He concluded that the rate of phonological development in his subjects was similar to So & Dodds' (1995) subjects in Hong Kong.

Table 4.4 illustrates an overview of Cantonese phonological development in Malaysian children and its comparison with Cantonese-speaking children in Hong Kong (So & Dodd, 1995)(see also Chapter 2):

Table 4.4: Age of acquisition for consonants in Cantonese

Age	Yoon (2001)	So & Dodd (1995)
2;00-2;11	p, t, k, m, n, ŋ, h, j, f, l, w, s, t ^h , ts	p, t, k, m, n, ŋ, h, j, l, w, f, s, ts, p ^h
3;00-3;11	p ^h , k ^h , ts ^h	t ^h , k ^h , ts ^h
4;00 & above	-	-

Yoon's (2001) preliminary study of Cantonese phonological acquisition has provided a valuable foundation for researchers interested in local Cantonese dialect acquisition. Further research using a larger sample and a more comprehensive analysis (e.g. of vowel, tone components) is needed in order to consolidate Yoon's (2001) findings.

4.3 BILINGUAL PHONOLOGICAL DEVELOPMENT STUDIES

4.3.1 Bilingual phonological development in English-Mandarin

Lim (2004) began to address the issue of Malaysian children's second language phonological acquisition. She conducted a study of bilingual Chinese children's phonological acquisition in English and Mandarin. Forty five children aged between 2;06 and 6;05 were recruited.

Using a cross-sectional study approach, Lim (2004) focused on core phonological aspects such as: consonant, vowel, stress (English only), and tone (Mandarin only) in both ambient languages. The findings revealed that the majority of the target consonants in both languages were acquired by 3;00, late acquired ones being /v, ʃ, θ, ð/ in English and /tʂ, ʃ/ in Mandarin. The common consonants shared by both languages, namely: /p, b, t, d, k, g, m, n, ŋ, f, s, h, l/ were acquired at about the same age. The major consonant error patterns (simplifications) found in Mandarin were stopping, consonant harmony, deaspiration, (de)retroflexion, initial consonant deletion, /ʃ/→[l] substitution; and, in English, stopping, gliding, fronting, /ʃ/→[l] substitution, consonant cluster reduction, final consonant deletion and devoicing.

Vowels were generally found to have been acquired before consonants in both target languages. The major error patterns causing vowel errors were observed to be substitution and reduction in both languages.

Tones in Mandarin were observed to have been acquired very early even by the youngest 2;01-2;06 age group. The most common tone error was Tone 1 being substituted by Tone 4 (e.g. ku1→ [k^hu4]). However, it was rather confusing for her to score the child's tone production as "wrong" in this particular example since, as the author acknowledged, this may be due to the influence of local Chinese dialects such as Hokkien. An important shortcoming of the study, as with most of the studies reported above, was the failure to provide clear scoring criteria in relation to local variants. This was a result of insufficient consideration of the adult input model.

Stress in English was said to have hardly used by the subjects, only three subjects have used stress on a few occasions. The non-usage or different placement of stress is the most prominent feature in Manglish (see Chapter 3), so it is again inappropriate to score stress placement against the British English system.

Lim's (2004) study has opened up a new direction towards a more comprehensive picture of Malaysian children's phonological acquisition. Therefore, owing to the shortcomings mentioned above, further research is necessary in order to validate her findings.

4.4 CONCLUSION

This overview of studies of phonological acquisition by Malaysian children indicates that further research using a larger sample size is highly desirable. A more sophisticated approach is required, taking careful consideration of the local adult phonological patterns, which needs to be translated into well-defined scoring criteria. Equally, clearly defined age of phoneme acquisition criteria are essential in this kind of phonological acquisition study. An important new dimension for child phonological acquisition research in Malaysia, opened up by Lim (2004), is to look at the child's second or even third language phonological acquisition i.e. bilingual or multilingual phonological acquisition, since, as is clear from the example of ethnic Chinese children in their local Chinese nurseries, Malaysian children may be learning two or three languages simultaneously.

CHAPTER 5

METHODOLOGY

5.0 INTRODUCTION

The main empirical research reported in this thesis is a cross-sectional study of 64 pre-school children aged between 2;06-4;05. Data collection took approximately four months, spread across a time span of eight months. This included two pilot studies and the main study. In this chapter, the methodology of the study is described. This includes information about the participants, test materials, the pilot studies, testing procedure, scoring procedure and inter-rater transcription procedure.

5.1 PARTICIPANTS

The participating children were recruited from nine private Chinese nurseries scattered around the capital Kuala Lumpur. These centres were used not only on the grounds of availability and convenience, but also because they introduce Malay as a teaching subject for the youngest age group studied here (2;06-2;11). Some Chinese nurseries do not introduce Malay to children aged below three years. This ensured that all children in the present study were having some exposure to all three languages (English, Mandarin and Malay) at the time of data collection. The parental consent form and head teacher consent form (Appendix 7) were distributed and collected prior to the testing date.

The 64 children in the main study were divided into four 6-month age bands. Sixteen children (eight male, eight female) were recruited for each age group, as shown in Table 5.1.

Table 5.1: Number of participants in each age group

Age group	Male	Female	Total
2;06-2;11	8	8	16
3;00-3;05	8	8	16
3;06-3;11	8	8	16
4;00-4;05	8	8	16
Total	32	32	64

The children were randomly selected from those children available in the nurseries who met the following criteria:

1. Malaysian Chinese ethnic origin, defined as having Malaysian Chinese parents.
2. Have some exposure to the three major languages used by the ethnic Chinese population, namely: English, Mandarin and Malay.
3. No reported mental and physical disorders, syndromic disorders, or hearing disorders.

Seventy five children were recruited initially. Nine children were excluded for one or more of the following reasons: poor attention, poor co-operation, poor overall language skills, shyness, functional voice disorder, autistic-like features (Criterion 3). One child was of Chinese-Indonesian parentage (Criterion 1).

5.1.1 Language background

The participants in this study can be considered to be representative of Malaysian Chinese children. The socio-linguistic background of these children is complex: home language usage profiles for individual participants are presented in Appendix 1. The parents of the children were consulted verbally on these children's home language usage profiles. Though pre-school education is optional in Malaysia, all these children had started their nursery fairly early i.e. by around 2;06-3;00. They were learning English, Mandarin and Malay in the nursery. According to the home language usage profile (see Appendix 1), the majority of participating children used a mixture of Mandarin and English at home; this is common as code-switching is a predominant speech style for Malaysians (see Chapter 1). 39% of the children also used Southern Chinese dialects at home, of which Cantonese was most widely used (26.5%), followed by Hokkien (10.9%) and Hakka (1.6%). 31% of the families had a live-in Indonesian maid at home, a situation which is likely to have resulted in a slightly better command of Malay in some of these children. In Malaysia, regardless of race, in families where both parents are working, it is common to have domestic workers from neighbouring countries, in particular Indonesia, to take care of the children and to do house chores. These Indonesian domestic workers normally speak only the Malay language. As alluded to in Chapter 3 (see Figure 3.7), the Malay language is primarily used in Malaysia, Indonesia, Singapore, Brunei and East Timor, these five countries have been described as "the core of the Malay region" (Gupta, 2003).

Because of the complex linguistic background and the predominance of code-switching among this population, it is hard to rate the child's language (and dialect) dominance, in particular between English and Mandarin, which are generally the two most dominant languages (see Chapter 2). Malay is generally the weakest language, it is only used when there is a live-in Indonesian maid in the family as mentioned above. Typical Malaysian Chinese families use either Mandarin, English or Chinese dialects at home, particularly Mandarin and/or English, as indicated in the children's home language usage profile (see Appendix 1).

It is important to study the languages used at the nursery school because school has a tremendous effect on the children's choice of language use. In speech-language therapy clinical practice in Malaysia, it is common to have parents reporting how a child's dominant home language changed as a result of school changes e.g. a child who normally speaks in Mandarin with the families at home suddenly switched to English because of a change from Mandarin-based nursery to an English-based nursery.

This description of the socio-linguistic background of the multilingual children participating in the study indicates the uniqueness of this population. Despite having complex and diverse language backgrounds, they are generally more dominant in English and Mandarin but weaker in Malay. About one-third of them have also used Chinese dialects at home. These Southern Chinese dialects have influenced the Mandarin accent giving birth to a local variety of Mandarin coined as Maldarin (Malaysian Mandarin); the accents in English and Malay are described in the local literature (see Chapter 3). Because of their fairly early exposure to Malay in the nursery (2;06-3;00), and their simultaneous learning of Malay with English and Mandarin in the nursery, the children's phonological acquisition in Malay can be treated loosely as "simultaneous" with their phonological acquisition in English and Mandarin (see Chapter 3). However, strictly speaking, their Malay phonological acquisition comes after their phonological acquisition in English and Mandarin i.e. generally in their third year of life; and it is also different from the other two languages in the sense that it is generally acquired through formal classroom learning.

5.2 TEST MATERIALS

Three single-word phonology naming tests were devised by the researcher: "Malaysian English (Manglish) Phonology Test", "Malaysian Mandarin (Maldarin) Phonology Test", and "Chinese Malay (ChinMalay) Phonology Test" (see Appendix 5-6). Each test consists of three parts: a single-word naming test a word production consistency sub-test, and an intonation imitation sub-test. The

structure of each test is presented in Table 5.2. The details of the intonation test are given in Chapter 8.

Table 5.2: Test battery in English, Mandarin and Malay

Single-word phonology naming test: <ul style="list-style-type: none"> • Singleton consonant • Cluster (English only) • Vowel • Syllable structure • Tone (Mandarin only)
Word production consistency sub-test
Intonation imitation sub-test

5.2.1 Single-word phonology naming test

Single word productions were elicited through a picture naming task. The test words in the present study were adapted from research versions of tests used in previous phonological acquisition studies in the three languages: English (Lim, 2004), Mandarin (Lim, 2002) and Malay (Badrulzaman, Lim & Sandra, 1999), reviewed in Chapter 4. Adaptations were needed mainly because the earlier tests were only concerned with consonants, other core aspects of phonology such as vowels being neglected. Selection of test items was further informed by the researcher's knowledge derived from extensive clinical experience with Malaysian Chinese children. In addition, the teachers at the nurseries involved were consulted and proved to be a reliable source of information on the familiarity of words to the children. Most of the test words were simple nouns familiar to children (e.g. EAR). Some simple verbs (e.g. EATING) and adjectives (e.g. RED) which were familiar to children were also adopted. The test words used were all age appropriate as well as culturally appropriate. All test words were represented in picture form. The pictures were all hand-drawn, coloured, scanned, laminated and bound. Illustrations of the following test items are presented in Appendix 8: CHICKEN, RED for the English test, TANG2GUO3 (sweeties), KU1 (to cry) for the Mandarin test, and RUMAH (house), HUJAN (to rain) for the Malay test. The pictures were 5 inches x 8 inches in size and colourful in nature in order to attract the child's attention.

As far as possible, all the consonants, vowels, syllable structures and tones (for Mandarin) of each language were targeted. The English test consisted of the greatest number of words (56 words) compared to Mandarin (38 words) and Malay (26 words). This is mainly because English has a larger consonantal inventory as well as consonant clusters. Clusters are not found in the other two languages. Malay had the smallest number of test words mainly because it had

the smallest vowel and consonant inventories compared to the other two languages (see Table 5.3).

With the exception of intonation (see Chapter 8), in the following sections, the key components of the three tests will be described in terms of frequency of occurrence for the target consonants, vowels, syllable structures, tones and word production consistency. These are summarised in Table 5.3. The acceptable phonological variants for phonological targets are indicated on the phonological production scoring form in Appendix 5. They were described in detail in Chapter 3, and are discussed further under “scoring procedure” later in this chapter (see section 5.6).

Table 5.3: Summary of test battery

Number of target item	English (Manglish)	Mandarin (Maldarin)	Malay (ChinMalay)
Total test word	56	38	26
Intra-word consistency item	5	5	5
Consonant (including cluster for English only)	41	22	19
Vowel	12	19	8
Monosyllabic word	8	9	1
Disyllabic word	9	14	6
Trisyllabic word	2	1	0
Tone & tone sandhi	0	5	0
Intonation	2	2	2

English

Fifty six items were used in the English (Manglish) single-word phonology naming test (see Appendix 5-6). Where items were excluded, this was because there were no words containing these targets that were familiar to the children. All twenty three English (also Manglish) consonants were tested in all three word positions, except for medial fricative /θ/, medial and final fricative /ʒ/, medial fricative /h/, as well as medial affricate /tʃ/. Eighteen initial CC-clusters were tested. All target singleton consonants were tested in at least two different test words. All eight monophthongs in Manglish were tested at least once. Four out of the five Manglish diphthongs (except for /uə/) were included (see Chapter 3). Stress was not targeted in the test, as Manglish is syllable-timed, with a tendency to a single pattern of final stress. Stress thus has no semantic implications (see Chapter 3).

Mandarin

Thirty eight items were used in the Mandarin (Maldarin) single-word phonology naming test (see Appendix 5-6). The controversy over the definition of Mandarin word structure has been well documented (see Chapter 3). As the main focus of the present research was on phonological production, each “word” or “character” (logographic writing system in Mandarin) or “morpheme” was treated as a syllable. For instance, TOU2 (head) is considered as a monosyllabic word, YA2CHI3 (teeth) a disyllabic word, and NU3HAI2ZI3 (girl) a trisyllabic word. All twenty two initial consonants and two final consonants in Mandarin (also Maldarin) were tested (see Chapter 3). All consonants were tested in various word positions, except for medial stops /p^h, t^h, k^h/, medial nasal /n/, medial affricates /ts^h, tʃ, tʃ^h/, and medial fricatives /s, ʃ/ due to absence of familiar words. All target consonants were tested in at least two different test words. All six monophthongs, nine diphthongs, and four triphthongs in Mandarin were tested for at least once. All four basic tones in Mandarin alongside third tone sandhi were also tested (see Chapter 3). The test included all monosyllable structures in Mandarin except for GVG, VC and VG, giving an overall total of nine monosyllable structures, fourteen disyllable structures and one trisyllable structure.

Malay

Twenty six items were used in the Malay (ChinMalay) single-word phonology naming test (see Appendix 5-6). All nineteen initial consonants in Malay (also ChinMalay) were tested. The following were excluded because there were no words containing these targets that were familiar to the children, and/or they have a marginal status, mainly occurring in rare loan words: final plosives /p, b, d, g/, initial and medial glottal stop /ʔ/, medial fricative /h/, final affricates /tʃ, dʒ/, and initial nasal /ŋ/. All target consonants were tested in at least two different test words. All six monophthongs in Malay plus one loan vowel from English i.e. /ɛ/ were tested for at least once. On the other hand, all three diphthongs were excluded because there were no words containing these targets that were familiar to the children. Only one vowel sequence was tested i.e. /au/. Overall, the test included one monosyllable structure and six disyllable structures, as the vast majority of Malay words are disyllabic (see Chapter 3). Trisyllable structures were not tested. Stress in ChinMalay was not targeted in the test, as Malay is a syllable-timed language, and stress in Malay has no semantic implications (see Chapter 3). From the present analysis of the stress production in the two nursery teachers plus observation of other ChinMalay speakers, as with Manglish (by Chinese speakers), stress in ChinMalay is restricted to a single pattern of final stress (as opposed to a primary stress on the penultimate syllable in both disyllabic and polysyllabic words in Malay)(see Chapter 3).

5.2.2 Word production consistency test

Five items from each single-word phonology naming test were repeated at the end of the test for “intra-word consistency of production” (see Appendix 5-6). The consistency items are presented in Table 5.4. These five single-words were selected based on the following criteria: variety of consonants i.e. singleton and cluster (English only), variety of vowels, variety of syllable structures, tones (Mandarin only) and challenging sounds such as [z, dʒ, v] in English, [tʂ^h. ʨ] in Mandarin and [r, ɲ] in Malay (see Table 5.5 c.f. Dodd & McCormack, 1995; Dodd, Zhu, Crosbie, Holm & Ozanne, 2002; Holm, Crosbie & Dodd, 2007).

Table 5.4: Word production consistency test in English, Mandarin and Malay

English	Mandarin	Malay
ZOO [zu]	XI2SHOU3 [si2sou3]	ROTI [roti]
BANANA [bənanɑ]	CHI1FAN4 [tʂ ^h i1fan4]	SUSU [susu]
DRIVING [dʒaiviŋ]	JI1ROU4 [tsi1rou4]	BAS [bas]
CLOCK [klɒk]	NÜ3HAI2ZI3 [ny3xae2tsi3]	LORI [lori]
VAN [væn]	RE4 [ɽɤ4]	NYANYI [ɲani]

Table 5.5 Characteristics of word production consistency test items in English, Mandarin and Malay

Target word	Cons.			Vowel	Syllable structure	Tone
	Initial	Medial	Final			
English						
1.ZOO	z			u	CV	
2.BANANA	b	n, n		ə, ɑ, ɑ	CVCVCV	
3.DRIVING	dɪ	v	ŋ	aɪ, i	CCVVCVC	
4.CLOCK	kl		k	ɔ	CCVC	
5.VAN	v		n	ɛ	CVC	
Mandarin						
1.XI2SHOU3	s	s		i, ou	CVCVV	*T2, T3
2.CHI1FAN4	tʂʰ	f		ɨ, a	CVCVC	T1, T4
3.JI1ROU4	ts	ɹ		i, ou	CVCVV	T1, T4
4.NÜ3HAI2ZI3	n	x, ts		y, ae, ɨ	CVCVVCV	T3, T2, T3
5.RE4	ɹ			ɤ	CV	T4
Malay						
1.ROTI	r	t		o, i	CVCV	
2.SUSU	s	s		u, u	CVCV	
3.BAS	b		s	a	CVC	
4.LORI	l	r		o, i	CVCV	
5.NYANYI	ɲ	ɲ		a, i	CVCV	

Cons.: consonant.

**Originally T3, but because it precedes another T3, it becomes T2 (third tone sandhi)(see Chapter 3).*

5.3 PILOT STUDY

Two pilot studies were conducted prior to the main study, to check on the suitability of the test words and the test pictures. In the first pilot study, two children (one boy from the youngest age group and one girl from the oldest age-group) were asked to do the three phonological tests. It appeared that both children were not familiar with the following words since they gave no spontaneous responses when the pictures were presented to them for naming: TELEPHONE, KITCHEN, BUTTER, TELEVISION, BRIDGE in the English test; CHANG2JING3LU4 (giraffe), ZHI1ZHU1 (spider), MA3 (horse), DIAN4SHI4JI1 (television) in the Mandarin test; and GAJAH (elephant), TINGKAP (window), SABUN (soap), KERUSI (chair) in the Malay test. On the other hand, they had pluralized the English target word EAR.

In the revision of the test items, due consideration was given in selecting replacement words that are more familiar to children. The head nursery teacher was consulted on the researcher's proposed new list of familiar words to children. Eventually the following words (some nouns and verbs) were selected to replace the above unfamiliar words. The picture of "two ears" was also changed to "one ear" in order to avoid production of undesired plural-s i.e. EARS:

1. TIGER, DRIVING, ZOO, BREAD, ORANGE, SPOON, DADDY for English.
2. XI2SHOU3 (to wash hands), CHONG1LIANG2 (to shower), MA1MA1 (mother), QI1 (seven), KU1 (to cry), DI4DI4 (younger brother) for Mandarin.
3. TANGAN (hand), SUSU (milk), MEJA (table), RUMAH (house) for Malay.

A second mini pilot study was conducted in order to confirm the suitability of the above revised test words. Four children (two boys and two girls) from each age group were asked to name the above revised test items. These revised test items were confirmed to be more familiar to the children. All four children were able to name virtually all the words spontaneously. The revised picture of the English EAR i.e. a single ear was also better in eliciting the desired singular EAR. All four children named the English EAR without the plural.

5.4 TESTING PROCEDURE

The children were assessed individually in a quiet room at their nursery by the researcher. The entire test session took approximately 30-45 minutes. The test sessions of all 64 children were recorded. Both high quality Sony digital video cam-corder (Digital 8 DCR-TRV285E) and Sony IC audio-recorder (ICD SX35) were used. The IC audio-recorder was clipped to the child's collar, thus lip to audio-recorder distance was maintained at approximately 15cm.

The child was encouraged to name the pictures spontaneously, in the absence of which cues and prompts would be given. Semantic cues (e.g. gesture, functions, gap fills) were given, prior to forced-alternative choices (e.g. "Is it a helicopter, motorbike, or van?") and finally direct imitation (e.g. "Can you say van?"). If the child did not respond, up to three maximum direct imitation attempts would be given. One mark was given for correct response and a zero mark was given for wrong/nil response; these marks were entered on the scoring form.

The tester tried to be consistent in implementing the cueing and prompting procedure. This was possible as the researcher was the sole tester in the main study as well as the pilot study. As far as possible, similar cues and prompts were given for the same test words across all participants. For instance, for the test word VAN, semantic cue i.e. "Vroom vroom... a big car, we call it a ___ ?", followed by forced-alternative choice i.e. "Is it a helicopter, motorbike or van?", and finally "Can you say van?" were always given. Cued responses were recorded on the scoring form. As with spontaneous responses, one mark was given for correct response and a zero mark was given for wrong/nil response.

The tests took approximately 30-45 minutes with the English test being the longest one and the Malay test being the shortest one. Although the researcher tried to administer all three tests within the same day (with little breaks in between where necessary, for especially the youngest children), three children had to split their tests over two test sessions with an interval of three days (for two subjects), and six days (for one subject), due to absence and school timing factors.

Clear instruction with trial items was given to the child at the beginning of the test. The child was rewarded upon completion of the test as promised i.e. with a little chocolate or sweeties, or whenever necessary, e.g. to encourage a shy child to keep going with the test, or to draw the attention of a child who has started showing sign of boredom. These rewards proved to be an effective reinforcement for the children.

5.5 PARTICIPANTS' RESPONSE TO THE TEST BATTERY

In order to contextualize the scoring of children's responses to the three separate phonology tests, some of the ways in which these multilingual children approached the task of responding to the test battery, particularly their use of translation equivalents pairs and triplets (Mikes, 1990), are now described.

The multilingual children used extensive translation equivalent pairs particularly between English and Mandarin in the phonological tests of English and Mandarin. For instance, when the English test picture of TABLE was presented, one child spontaneously said: "zhuo2zi3, table". When the English TEETH picture was presented, another child spontaneously said: "teeth, ya2chi3". In one interesting instance, when the English EAR picture was presented, a child spontaneously said in the three languages (triplets): "er3, telinga, ear". Similar responses were observed on the Mandarin test: when the Mandarin PAI1SHOU3 (to clap hands) picture was presented, a child spontaneously said: "clap, pai1shou3". When the Mandarin picture FEI1JI1 was presented, the same child spontaneously said "aeroplane, fei1ji1". Sometimes, the children named the pictures in the other language spontaneously even though they knew the vocabulary in the target language. For instance when the English picture of NOSE was presented, one child said in Mandarin: "bi2zi3", but when she was reminded by the tester: "Can you say it in English?" she was able to name in English instantly: "nose". In another example on the Mandarin test, when the picture of Mandarin KOU3 (dog) was presented, many children, particularly the youngest ones spontaneously named in English: "dog" but once they were reminded by the tester, they were able to name in Mandarin instantly: "kou3."

Spontaneous translation equivalents between English and Malay, as well as between Mandarin and Malay, were only occasionally observed in a few children. This presumably reflects the children's lower proficiency in Malay. The following examples were observed from a child who was apparently as proficient in Malay as Mandarin and English: "kuda, horse" for English HORSE; and "cat, kucing" for Malay KUCING. Likewise, spontaneous translation equivalents between English and Cantonese, as well as between Mandarin and Cantonese were only observed occasionally.

Sometimes, as opposed to the resultant great vocabulary knowledge in two languages, as manifested in the use of translation equivalent pairs, a lack of vocabulary knowledge in the target language was also evident in the children, particularly the youngest children's, manifested in their lexical borrowings between English and Mandarin. For example, one child used Mandarin "ji1rou4" to replace the English CHICKEN, and was unable to choose the right target in English even when the forced choices were provided. The child was finally able

to name CHICKEN when direct imitation was provided. Likewise, another child used English “goat” for Mandarin YANG2 and was unable to choose the right target in Mandarin even when the forced choices were provided. The child was finally able to name YANG2 with direct imitation being provided. The consequence of these lexical borrowings in especially the youngest children was the main cause of imitated data in the present study (see Chapter 7).

On the other hand, the spontaneous translation equivalents with Malay as one language in the pair occurred much less often in the Malay test, as children are generally less proficient in Malay. Most children particularly the youngest ones used lexical borrowings from English and Mandarin in naming the Malay test words, for example, when the same picture of Malay IKAN (fish) was presented, one child said: “fish, yu2” but was unable to say it in Malay even when the forced alternative choices in Malay were provided. When the forced choices were provided, many children, particularly the older ones, were able to select the right choice.

Translation equivalents and lexical borrowings fall beyond the scope of the present study. The description of them shows that the present study children subjects are proficient multilingual compared to many children cited in the past studies (see Chapter 2). Their use of code-switching strategies and code-mixing strategies are also demonstrated in their free conversation with the tester. These strategies are a result of influences from the adults in the multilingual society, which indicates how closely children develop their phonologies to the adult targets. The implication of which suggests the importance of looking at the adult targets in this kind of phonological acquisition study.

5.6 SCORING PROCEDURE

5.6.1 Establishing a benchmark for scoring

A novel feature of the present study is the inclusion of a full adult phonological input model in the scoring and the analysis of the children’s phonological production. The adult phonological input model is derived from two sources. The first is the description of prominent phonological features of Manglish (Malaysian English), Maldarin (Malaysian Mandarin) and ChinMalay (Chinese Malay), available in the local literature (see Chapter 3). The second source is the present analysis of the pronunciation of two nursery teachers in the immediate linguistic environment of the children subjects. The phonological features derived from both these sources provide the benchmark for scoring and analysis of the children’s responses on the test batteries.

5.6.2 Teachers' pronunciation as local norms

The pronunciation of two nursery teachers from the present study location was analysed (see rationale for using teachers instead of parents in Chapter 3). The two female teachers were randomly selected from one of the participating nurseries. They are representative of typical Malaysian Chinese at large (see Chapter 3). The teachers were asked to do the same single-word phonology naming tests in the three languages that the child participants did. In general, the procedure followed with the children was adopted with the teachers in terms of test materials (see section 5.2) and recording (see below), though unlike the children, the adult teachers did not need cues in the naming of the test words. Prior to testing, the tester had an informal conversation with each teacher in an attempt to create a relaxed atmosphere. This was easy as the teachers are familiar to the tester. When responding to the naming tests the teachers were requested to use their habitual pronunciation, as used in the classroom. The sessions went smoothly and the teachers named the pictures confidently. They rarely had to be asked to repeat so that a more precise transcription could be obtained. In such cases, both productions were subsequently incorporated into the scoring form as acceptable targets, since standard and non-standard pronunciations are commonly used inconsistently and interchangeably by Malaysian Chinese speakers (see Appendix 4 & Chapter 3).

The sessions were audio-recorded and transcribed by the tester; the transcription was then checked by another experienced phonetician. These transcriptions (see Appendix 4) were transferred to the scoring forms (see Appendix 5), as variant acceptable targets. Thus, the teachers' pronunciation on the three tests was adopted as the standard local adult pronunciation, represented on the scoring forms. For example, on the scoring form, the target English NOSE was pronounced by both teachers as [nos] rather than standard (RP) [nəʊz]. This [nos] realization is a standard local pronunciation, being widely used by Malaysian Chinese speakers. Hence if a child pronounced NOSE as [nos] on the Malaysian English (Manglish) Phonology Test, this would be scored as a correct production. As many of these local adult pronunciations, like the processes observed in children's phonological development, can be described in terms of universal simplification patterns and markedness (see Chapter 2), a clear distinction needs to be made between these adult variants and the children's developmental patterns. While analysis of the underlying processes that give rise to the adult teachers' phonological variants falls beyond the scope of the present study, this distinction will be returned to when interpreting the results of the main study.

Most of the teachers' prominent features elicited via the tests are similar to those commonly reported in the literature (see Chapter 3), they are summarized below:

1. For Manglish: a simplified English vowel system with monophthongised diphthongs, and no triphthongs, plus raised vowels and shorter vowels. Systemically and structurally simplified consonants: variations of fricatives /θ, ð/, /v/ and approximant /ɹ/, deaspiration of voiceless plosives, affricate and fricatives /p, t, k, tʃ/, devoicing of final voiced obstruents /b, d, g, v, z, dʒ/, glottalisation of final plosives, as well as deletion of final /l/.
2. For Maldarin: systemically simplified vowels and consonants such as /y/ being replaced by [i]; the medial of the diphthongs, and the ending of diphthongs and triphthongs were frequently weakened or omitted (e.g. /uo/→[^uo], /ou/→[o^u], /ueɪ/→[ue]). Deretroflexion of affricate and fricatives /tʃ, tʃ^h, ʃ/, variations of /ɹ/, as well as lowering of pitch contours of all four tones.
3. For ChinMalay: fewer systemically and structurally simplified vowels and consonants were observed in ChinMalay compared to Manglish and Maldarin: lowering of vowel /o/, insertion of a glottal stop after /o/ in the word ROTI, use of Literary Malay vowels in the words KUCING and MEJA. Variations of alveolar trill /r/, deletion of final /l/, deletion of final glottal fricative /h/, as well as deaspiration of initial bilabial plosive /p/.

5.6.3 Scoring forms

The local phonological variants indicated in the scoring forms (see Appendix 5) were based on the phonological features documented in the literature of Manglish, Maldarin and ChinMalay, alongside the present analysis of the pronunciation of the two Malaysian Chinese nursery teachers (see section 5.6.2 above). Segments that are irrelevant are left empty in the column of the scoring forms (Goldman & Fristoe, 2000). The overall production accuracy for each target segment is counted based on mean percent correct (see Chapter 6).

The standard and non-standard realizations of the teachers' consonants, vowels, syllable structures and tones (Mandarin only) in the three languages are indicated in the scoring forms (see Appendix 5). There are seven columns in the form for both the English and Malay tests, but with an additional eighth column for tonal production in the Mandarin test. Take the English test for illustration first, from the left most to the right most columns: 1. The target word is placed in the first

column e.g. SNAKE (see item no. 10). 2. The teachers' most standard realization for SNAKE is transcribed in the second IPA column [snek]. 3. The associated target syllable structure CCVC for SNAKE is placed in the third column for scoring. 4. The target initial consonant for /sn/ is placed in the fourth column for scoring. 5. The target medial consonant for SNAKE is not relevant and thus the fifth column is left empty with a dash. 6. The target final consonants for SNAKE /ʔ/k/ are placed in the sixth column for scoring, where the left segment [ʔ] represents the most commonly used variant for SNAKE by the teachers, whilst the right segment [k] represents the standard RP realisational form also used by the teachers. The standard RP realisational form not used by the teachers is indicated with a bracket on the right segment, e.g. [s/(z)] where RP final [z] in NOSE (item no. 2) is always replaced by [s] in both teachers. In the other test words like SMALL [smɔ] (item no. 14), where the most commonly used variant by the teachers is segment deletion i.e. deletion of final [l], a symbol of [∅] is applied to the left segment, and where preservation of RP final [l] is also not found in the teachers, a bracket is applied to the right segment [∅/(l)]. 7. The target vowel [e] used by the teachers is indicated in the seventh column for scoring. This format is also applied to the other two languages.

Likewise, for Mandarin: 1. The target word is indicated in the first column e.g. YA2CHI3 (item no. 2). 2. The teachers' most standard realisational form is indicated in the second IPA column: [i̇ȧ2t^hʃ̇i̇3]. 3. The associated target syllable structure GV-CV for YA2CHI3 is placed in the third column for scoring. 4. The target initial consonant for YA2CHI3 is not relevant and thus the fourth column is left empty with a dash. 5. The target medial consonants /t^hʃ̇i̇3/t^hʃ̇i̇3/ are placed in the fifth column for scoring, where the left segment represents the most commonly used variant by the teachers, whilst the right segment [t^hʃ̇i̇3] represents the standard Putonghua realisational form also used by the teachers. 6. The target final consonant for YA2CHI3 is not relevant and thus the sixth column is left empty with a dash. 7. The target vowels /i̇ȧ/ and /i̇/ used by both teachers for YA2CHI3 are indicated in the seventh column for scoring. 8. The target tones /2/ and /3/ for YA2CHI3 used by both teachers are indicated in the last eighth column for scoring. In the test words like TOU2 (item no. 3) where there are different vowel variants used by the teachers e.g. [o^u/ou], the left segment [o^u] represents the most commonly used variant by the teachers, whilst the right segment [ou] represents the standard Putonghua realisational form also used by the teachers. Likewise, in the test words like KU1 (item no. 4), where there are two tonal realizations by both teachers, the left tone digit represents the most commonly used tonal variant by the teachers e.g. [4/1] whilst the right tone digit [1] represents the standard Putonghua tonal realisation form also used by the teachers. In the other test words like SHUI4JIAO4 (item no. 5)

where Putonghua realisational form is not found in the teachers, a bracket is applied to the right segment e.g. [uɪ/(ueɪ)] for SHUI4.

In Malay, the same format is used. 1. The first column represents the target words e.g. ROTI (item no. 8). 2. The teachers' most standard realisational form [rotɪ] is indicated in the second IPA column. 3. The target associated syllable structure CV-CV for ROTI is indicated in the third column for scoring. 4. The target initial consonants [ɹ/r] are placed in the fourth column for scoring, where the left segment [ɹ] represents the most commonly used variant by the teachers, whilst the right segment [r] represents the standard Malay realisational form also used by the teachers. 5. The target medial consonant [t] used by the teachers is indicated in the fifth column for scoring. 6. The target final consonant for ROTI is not relevant and thus the sixth column is left empty with a dash. 7. The target vowels [ɔ/o] and [i] used by the teachers are indicated in the seventh column for scoring, where the left segment [ɔ] represents the most commonly used variant by the teachers, whilst the right segment [o] represents the standard Malay realisational form also used by the teachers. In the other test words like PENSEL [pensə] (item no. 15) where the most commonly used variant by the teachers is segment deletion i.e. final [l] deletion, a symbol of [ø] is applied to the left segment, and where preservation of standard Malay final [l] is also not found in the teachers, a bracket is applied to the right segment [ø/(l)]. However in the test word EPAL (item no. 11), where both segment deletion of final [l] and preservation of standard Malay final [l] are found in the teachers, the right segment of [l] is not bracketed: [ø/l].

5.6.4 Transcription and scoring of children's responses

All child responses were phonetically transcribed on the test scoring forms by the researcher using IPA symbols and diacritics. The Goldwave freeware sound editing programme was used to segment and replay the audio-recorded data. The target consonants, vowels and syllable structures and tones (Mandarin only) were then scored in relation to targets indicated on the scoring forms, based on the local accents of Manglish, Maldarin and ChinMalay.

The responses elicited via naming and cueing were treated the same in the scoring. Both types of responses were combined in scoring and data analysis for the following reasons:

1. Studies have reported no significant differences in performance when comparing spontaneous data with cued data elicited through picture naming tests on children aged between 2;00 and 6;00 (e.g. Templin, 1947; Painter & Bumpas, 1977).
2. A lack of spontaneous naming responses in the youngest age group generally in the three languages, and particularly, in Malay. A lack of spontaneous data was also found in some children in the older age groups in either Mandarin or English.
3. Because of a lack of spontaneous data in the youngest children, some studies have combined both spontaneous and cued data in the analysis of the youngest age group only (e.g. Dodd, Holm, Zhu & Crosbie, 2003). In the present study, it is felt more consistent to combine both types of data in the analysis across the board i.e. in all age groups, rather than just the youngest age group.

5.6.5 Implications of using local norms when scoring children's responses

It was important to take on board local variants so as to avoid misinterpreting the child's production as a developmental error rather than a result of influence from the adult phonological input. For instance, "deaspirating aspirated sounds" and "unreleasing final plosives", both prominent phonological features of English spoken by the Chinese speakers with Southern Chinese dialect background were interpreted as developmental patterns by the bilingual Chinese children in the past studies (Holm & Dodd, 1999b, 2006)(see Chapter 2). A second example, deletion of English final /l/ in a four-year-old British child would be scored as a developmental error based on RP standard (see Table 2.3 in Chapter 2). However, in Manglish, deletion of English final /l/ is commonly used by the adults including the nursery teachers (see Appendix 4), thus it is inappropriate to score such pronunciation by the children in the present study as a developmental error. Another example from Mandarin is deretroflexion of /tʂ, tʂ^h, ʂ, ʐ/ → [ts, ts^h, s, ɹ/. This prominent phonological feature of Mandarin spoken by the Chinese speakers with Southern Chinese dialect background was interpreted as a developmental error pattern in the speech of bilingual Chinese children in past studies (So & Leung, 2006), as discussed in Chapter 2. In Mandarin, this deretroflexion is commonly used by adults including the nursery teachers (see Appendix 4). It would therefore be inappropriate to score such realization as a developmental error, as it is in fact a direct effect of exposure to the adult phonological input model. For Malay, final /h/ is always preserved in native Malay speakers, but it is often deleted in Chinese adults, including the nursery teachers (see Appendix 4), thus it is inappropriate to score final /h/ deletion in the test word RUMAH as an incorrect production in the children.

Some variants required special consideration because of a discrepancy between the description in the literature and the teachers' pronunciation. For example, /ɹ/ɹ/r/→[l] substitution in the three languages are commonly cited in the local literature, however the standard realisations of /ɹ/ɹ/r/→[ɹ/ɹ/r] in all three languages were actually present in the teachers' pronunciation, though the non-lateral forms were used inconsistently and/or interchangeably (e.g. /ɹ/→ [ɹ. r] in English, /ɹ/→ [ɹ, ɹ, dʒ] in Maldarin and /r/→[r, r, ɹ] in Malay (see Appendix 4). Nowadays, the majority of the average educated speakers are observed to use the standard form of these consonants in their speech particularly in the context of single-word naming. This view was supported by the finding, from the present study, of an age-related shift in the production of /ɹ/ɹ/r/, towards non-lateral realisations. Hence /ɹ/ɹ/r/→[l] substitution was scored as an incorrect production in the children (see Table 7.9 in Chapter 7). Likewise, the initial English /v/→[w] substitution is sometimes reported as a feature in Manglish (see Chapter 3). However the standard form of /v/→[v] was found in both teachers' pronunciation, thus /v/→[w] was scored as an incorrect production in the children (see Table 7.13). Another example from vowels is that /o/→[ɔ] is a variant in Maldarin and native Malay, but not in Manglish. The shared target word of YOYO in both Malay and English was always /jɔjɔ/→[jɔjɔ] in the teachers where /o/→[ɔ] was absent, probably because it is a loan word from English, it is always pronounced as English YOYO in Malay. Hence /o/→[ɔ] in both Malay and English YOYO were scored as an incorrect production when used by the children (see Table 7.36 in Chapter 7).

5.6.6 Scoring of word production consistency test

Five items from each single-word phonology naming test were repeated at the end of the test for intra-word consistency of production. Scoring of the test is illustrated in Table 5.6. A score of one mark was given to each test word that was consistently produced over the two trials irrespective of whether the pronunciation matched the targets. Inconsistency that took the form of local pronunciation variants was not taken into account, as they are socio-linguistic variants and not developmental variants; this is exemplified by item no (4) CLOCK, where final [k] and [ʔ] are treated as the same. As discussed earlier, even in the adult speakers, both standard forms and non-standard forms of a certain segment are frequently used interchangeably or inconsistently in the three languages.

Table 5.6: Examples of scoring for word production consistency test in English

Test word (n=5)	First trial	Second trial	Consistency score (total=5)
1. ZOO	zul	zu	0
2. BANANA	bənɑnɑ	bənɑnɑ	1
3. DRIVING	dwaiwiŋ	dʒaiʋiŋ	0
4. CLOCK	kloʔ	klok	1
5. VAN	wɛn	wɛn	1

5.7 INTER-TRANSCRIBER RELIABILITY

The test data of four children (6%), one from each age group, was independently transcribed by a local speech-language therapist who speaks the three languages being tested. This transcriber was a former graduate from the Speech Sciences programme at a local university (see Chapter 1) who had undergone phonetic transcription training. Both audio- and video- recordings together with scoring forms were provided. The transcriber was instructed in the procedures that had been used by the researcher when scoring the data. The degree of transcription agreement was calculated based on percentage of agreement. Overall the transcription reliability was high: 96% for consonants, 99% for vowels and 99% for tones.

CHAPTER 6

RESULTS OF THE MAIN STUDY: QUANTITATIVE ANALYSIS

6.0 INTRODUCTION

In this chapter, a quantitative analysis of the main study results will be described in order to answer the first five research questions set out in Chapter 1 (see section 6.1 below). Children's production of consonants, vowels, syllable structures, tones (Mandarin only) and consistency of word production in the three languages were analysed.

6.1 HYPOTHESES

The following hypotheses were tested:

1. It is hypothesised that there is a significant age effect in each language for production accuracy of the following:
 - a. i. consonants.
ii. vowels.
iii. syllable structures.
 - b. It is hypothesised that there is no significant age effect for production accuracy of Mandarin tone.
2. It is hypothesised that there is a significant age effect in each language for consistency of word production.
3. It is hypothesised that there is a significant relationship among the three languages for production accuracy of the following:
 - i. consonants.
 - ii. vowels.
 - iii. syllable structures.
4. It is hypothesised that there is a significant relationship among the three languages for consistency of word production.

The effects of gender are not explored in the present study, as past studies have reported no gender effects for phonological development in children younger than five years old (see Chapter 2).

6.2 PRODUCTION ACCURACY

As ceiling effects plus heterogeneity of variance were present, non-parametric tests were used. The Kruskal-Wallis One-Way Analysis of Variance test (Siegel & Castellan, 1988; Howell, 2002) was performed to determine if there was a significant difference across all age groups. When a significant difference was found at $p < 0.05$, a post-hoc Mann-Whitney test (Siegel & Castellan, 1988; Howell, 2002) was used to further investigate age-related differences in performance.

6.2.1 Consonants

6.2.1.1 Singleton consonants

Children's consonant production was scored against adult pronunciation targets based on a "correct" or "wrong" criterion (see Chapter 5). Every child's consonant production accuracy was measured by percent correct converting from raw score in each language (see Chapter 5) using the formula below (Shriberg & Kwiatkowski, 1982):

$$\frac{\text{Total number of consonants produced correctly} \times 100\%}{\text{Total number of consonants tested}}$$

Mean percent correct and standard deviation for each age group for consonant production accuracy was calculated to determine if there was an age effect on children's consonant acquisition.

Age effects

Mean percent correct and standard deviation for each age group for singleton consonant production accuracy in each language are presented in Table 6.1:

Table 6.1: Singleton consonant production accuracy (mean percent correct & standard deviation) by age in English, Mandarin and Malay

Age grp \ Cons.	2;06-2;11 (n=16)	3;00-3;05 (n=16)	3;06-3;11 (n=16)	4;00-4;05 (n=16)	Whole group (n=64)
Eng. (n=98)	81.57 (10.38)	86.03 (7.25)	88.39 (10.98)	92.28 (7.52)	87.06 (9.78)
Mand. (n=62)	81.25 (18.12)	90.42 (11.04)	92.84 (11.72)	93.85 (12.02)	89.59 (14.12)
Mal. (n=62)	85.08 (11.15)	91.23 (7.24)	91.23 (8.51)	94.15 (6.17)	90.42 (8.91)

Eng.: English, Mand.: Mandarin, Mal.: Malay.

Cons.: consonant.

Age grp: age group.

n=16: sixteen children per age group.

n in the consonant column: number of target items for consonant.

Table 6.1 shows that generally there were improvements with age in singleton consonant production accuracy in all three languages. Statistical analysis confirmed that there were significant age effects on singleton consonant production accuracy in all three languages (*Kruskal-Wallis' $\chi^2=17.866$, $df=3$, $p=0.000$ for English; $\chi^2=12.545$, $df=3$, $p=0.006$ for Mandarin; $\chi^2=12.774$, $df=3$, $p=0.005$ for Malay).*

Post-hoc analysis (see Table 6.2) showed that generally there were significant improvements in singleton consonant production accuracy when comparing the youngest age group with the older age groups of at least 12 month-interval namely: 2;06 vs. 3;06 and 2;06 vs. 4;00. In addition, in English, age improvement was found when comparing the second youngest age group with the oldest age group namely: 3;00 vs. 4;00; and in Malay, a significant age improvement was also found when comparing the youngest age group with the second youngest age group of less than a 12 month-interval namely: 2;06 vs. 3;00. This confirmed that there were age-related changes in singleton consonant production accuracy between 2;06 and 4;05 in all three languages. Hence, it can be concluded that

there was a general developmental trend in the acquisition of singleton consonants in English, Mandarin and Malay.

Table 6.2: Age-related changes on singleton consonant production accuracy in English, Mandarin and Malay

Comparison of two age groups (n=16 each)	English consonant (n=98)	Mandarin consonant (n=62)	Malay consonant (n=62)
2;06 vs. 3;00	0.138	0.110	0.047*
3;00 vs. 3;06	0.051	0.239	0.867
3;06 vs. 4;00	0.171	0.381	0.239
2;06 vs. 3;06	0.010*	0.007*	0.017*
3;00 vs. 4;00	0.002*	0.08	0.210
2;06 vs. 4;00	0.000**	0.002*	0.000**

**Difference is significant at $p < 0.05$ level.*

***Difference is highly significant at $p < 0.001$ level.*

n=16 each: sixteen children per age group.

n in the consonant column: number of target items for consonant.

It is known from studies of a range of languages that different manners of articulation are mastered at different ages (see Chapter 2), it was therefore decided to explore whether or not the effect of age reported above was due to significant improvements in all manners of articulation. The breakdown of the articulation accuracy scores by manner of articulation is presented in Table 6.3. Further to Table 6.3, statistical analysis was carried out to investigate the effects of age on accuracy for each of the six singleton consonant manners of articulation:

Table 6.3: Singleton consonant manner of articulation accuracy (mean percent correct & standard deviation) by age in English, Mandarin and Malay

Age grp Man. of artic.	2;06-2;11 (n=16)	3;00-3;05 (n=16)	3;06-3;11 (n=16)	4;00-4;05 (n=16)	Whole group (n=64)
Plosive					
English (n=27)	86.81 (8.33)	92.82 (6.83)	92.59 (10.90)	96.30 (5.58)	92.12 (8.66)
Mandarin (n=13)	80.29 (22.11)	97.12 (8.37)	96.63 (9.72)	96.63 (11.57)	92.66 (15.47)
Malay (n=19)	92.11 (11.85)	95.72 (7.74)	98.36 (2.52)	96.38 (8.09)	95.64 (8.36)
Fricative					
English (n=29)	65.95 (17.98)	69.83 (15.70)	77.16 (20.10)	82.33 (17.35)	73.81 (18.56)
Mandarin (n=12)	86.98 (24.53)	86.98 (25.45)	94.79 (18.73)	95.31 (18.75)	91.01 (21.93)
Malay (n=7)	89.29 (17.69)	88.39 (22.27)	92.86 (16.50)	93.75 (18.79)	91.07 (18.61)
Affricate					
English (n=4)	78.13 (15.48)	81.25 (19.36)	84.38 (15.48)	87.50 (12.91)	82.81 (15.98)
Mandarin (n=17)	76.10 (24.81)	84.56 (23.02)	93.38 (13.39)	87.87 (23.77)	85.47 (22.13)
Malay (n=5)	83.75 (30.30)	95.00 (15.49)	92.50 (20.49)	98.75 (5.00)	92.50 (20.31)
Nasal					
English (n=23)	91.85 (13.27)	95.65 (8.40)	95.92 (11.39)	98.37 (2.69)	95.44 (9.84)
Mandarin (n=14)	91.52 (19.90)	98.66 (5.36)	95.98 (14.28)	98.66 (2.88)	96.20 (12.66)
Malay (n=19)	81.58 (17.93)	90.46 (8.64)	88.16 (16.36)	91.12 (6.85)	87.82 (13.55)
Lateral approximant					
English (n=7)	94.64 (10.27)	91.96 (12.74)	95.54 (11.33)	99.11 (3.57)	95.31 (10.19)
Mandarin (n=4)	73.44 (30.91)	90.63 (20.16)	81.25 (30.96)	90.63 (25.62)	83.98 (27.59)
Malay (n=4)	89.06 (15.73)	87.50 (15.81)	92.19 (15.05)	92.19 (11.97)	90.23 (14.51)
Approximant & trill					
English (n=8)	81.25 (12.08)	91.41 (12.68)	89.06 (11.06)	93.75 (7.91)	88.86 (11.80)
Mandarin (n=2)	40.63 (32.76)	59.38 (41.71)	53.13 (46.44)	90.63 (20.16)	60.93 (40.30)
Malay (n=8)	71.88 (9.68)	84.38 (13.31)	78.91 (16.28)	94.53 (6.40)	82.42 (14.38)

n=16: sixteen children per age group.

n in the manner of articulation column: number of target items for manner of articulation.

Plosives

According to Table 6.3, there appear to be improvements with age in plosive production accuracy in all three languages. Statistical analysis confirmed that there were significant age effects on plosive production accuracy in English and Mandarin but not Malay (*Kruskal-Wallis' $\chi^2=14.228$, $df=3$, $p=0.003$ for English; $\chi^2=12.649$, $df=3$, $p=0.005$ for Mandarin; $\chi^2=12.774$, $df=3$, $p=0.661$ for Malay). Hence, it can be concluded that there was a general developmental trend in the acquisition of plosives in English and Mandarin. However, there was no significant developmental trend in the acquisition of plosives in Malay.*

Post-hoc analysis (see Table 6.4) showed that generally there were significant improvements in plosive production accuracy in both English and Mandarin, when comparing the youngest age group with all the other older age groups namely: 2;06 vs. 3;00, 2;06 vs. 3;06 and 2;06 vs. 4;00. The age improvement in English plosive production accuracy when comparing the youngest age group with the oldest age group: 2;06 vs. 4;00 is highly significant. This confirms that there were age-related changes in plosive production accuracy between 2;06 and 4;00 in both English and Mandarin. The results suggest that most of the improvement takes place in the earlier part of the age range, since there are no significant changes between 3;00 and 3;06, 3;06 and 4;00, or 3;00 and 4;00.

Table 6.4: Age-related changes on plosive production accuracy in English and Mandarin

Comparison of two age groups (n=16 each)	English plosive (n=27)	Mandarin plosive (n=13)
2;06 vs. 3;00	0.024*	0.008*
3;00 vs. 3;06	0.363	0.676
3;06 vs. 4;00	0.325	0.676
2;06 vs. 3;06	0.014*	0.016*
3;00 vs. 4;00	0.325	0.676
2;06 vs. 4;00	0.000**	0.010*

*Difference is significant at $p<0.05$ level.

**Difference is highly significant at $p<0.001$ level

n=16 each: sixteen children per age group.

n in the plosive column: number of target items for plosive.

Fricatives

Table 6.3 shows that there may be improvements with age in fricative production accuracy in all three languages. Statistical analysis confirmed that there were significant age effects on fricative production accuracy in English only, but not Mandarin and Malay (*Kruskal-Wallis' $\chi^2=14.868$, $df=3$, $p=0.002$ for English; $\chi^2=7.738$, $df=3$, $p=0.052$ for Mandarin; $\chi^2=2.517$, $df=3$, $p=0.472$ for Malay). Hence, it can be concluded that there was a general developmental trend in the acquisition of fricatives in English. However, there was no significant developmental trend in the acquisition of fricatives in Mandarin and Malay.*

Post-hoc analysis (see Table 6.5) showed that there were significant improvements in English fricative production accuracy, when comparing the following age groups: 2;06 vs. 3;06, 3;00 vs. 3;06 and 2;06 vs. 4;00. This confirmed that there were age-related changes in fricative production accuracy between 2;06 and 4;00 in English.

Table 6.5: Age-related changes on fricative production accuracy in English

Comparison of two age groups (n=16 each)	English fricative (n=29)
2;06 vs. 3;00	0.609
3;00 vs. 3;06	0.037*
3;06 vs. 4;00	0.288
2;06 vs. 3;06	0.018*
3;00 vs. 4;00	0.288
2;06 vs. 4;00	0.002*

**Difference is significant at $p<0.05$ level.*

n=16 each: sixteen children per age group.

n=29: number of target items for English fricative.

Affricates

Table 6.3 suggests that there may be improvements with age in affricate production accuracy in all three languages. However, statistical analysis confirmed that there were no significant age effects on affricate production accuracy (*Kruskal-Wallis' $\chi^2=2.832$, $df=3$, $p=0.418$ for English; $\chi^2=7.060$, $df=3$, $p=0.070$ for Mandarin; $\chi^2=2.796$, $df=3$, $p=0.424$ for Malay). Hence, it can be concluded that there was no significant developmental trend in the acquisition of affricates in any of the three languages.*

Nasals

Table 6.3 suggests that there may be improvements with age in nasal production accuracy in all three languages. However, statistical analysis confirmed that there were no significant age effects on nasal production accuracy (*Kruskal-Wallis' $\chi^2=4.088$, $df=3$, $p=0.252$ for English; $\chi^2=3.716$, $df=3$, $p=0.294$ for Mandarin; $\chi^2=4.192$, $df=3$, $p=0.241$ for Malay). Hence, it can be concluded that there was no significant developmental trend in the acquisition of nasals in any of the three languages.*

Lateral approximants

Table 6.3 suggests that there may be improvements with age in lateral approximant production accuracy in all three languages. However, statistical analysis confirmed that there were no significant age effects on lateral approximant production accuracy (*Kruskal-Wallis' $\chi^2=3.724$, $df=3$, $p=0.293$ for English; $\chi^2=6.335$, $df=3$, $p=0.096$ for Mandarin; $\chi^2=1.324$, $df=3$, $p=0.723$ for Malay). Hence, it can be concluded that there was no significant developmental trend in the acquisition of lateral approximants in any of the three languages.*

Oral approximants and trills

Table 6.3 shows that there may be improvements with age in approximant and trill production accuracy. Statistical analysis confirmed that there were significant age effects on approximant and trill production accuracy in all three languages (*Kruskal-Wallis' $\chi^2=9.729$, $df=3$, $p=0.021$ for English; $\chi^2=14.083$, $df=3$, $p=0.003$ for Mandarin; $\chi^2=21.979$, $df=3$, $p=0.000$ for Malay). This confirmed that there were age-related changes in approximant and trill production accuracy between 2;06 and 4;05 in English, Mandarin and Malay. Hence, it can be concluded that there was a general developmental trend in the acquisition of approximants and trill in all three languages.*

Post-hoc analysis (see Table 6.6) showed that there were significant improvements in English approximant production accuracy, when comparing the following age groups namely: 2;06 vs. 3;00, 2;06 vs. 4;00. This suggests that most improvement takes place in the early part of the age range. There were significant improvements in Mandarin approximant production accuracy, when comparing the following age groups namely: 3;06 vs. 4;00, 3;00 vs. 4;00 and 2;06 vs. 4;00. This suggests that most improvement takes place from the age of 3;00 onwards. There were significant improvements in Malay approximant and trill production accuracy, when comparing the following age groups namely: 2;06 vs. 3;00, 3;06 vs. 4;00, 3;00 vs. 4;00 and 2;06 vs. 4;00. This suggests that

improvement takes place across the age range studied. The age improvements in Mandarin and Malay approximant and trill production accuracy when comparing the youngest and oldest age groups: 2;06 vs. 4;00 are highly significant. This indicates that the age range studied is an important one for the development of these manners of articulation.

Table 6.6: Age-related changes on approximant and trill production accuracy in English, Mandarin and Malay

Comparison of two age groups (n=16 each)	English approximant (n=8)	Mandarin approximant (n=2)	Malay approximant + trill (n=8)
2;06 vs. 3;00	0.024*	0.164	0.008*
3;00 vs. 3;06	0.444	0.716	0.340
3;06 vs. 4;00	0.233	0.013*	0.004*
2;06 vs. 3;06	0.074	0.412	0.188
3;00 vs. 4;00	0.881	0.018*	0.019*
2;06 vs. 4;00	0.003*	0.000**	0.000**

*Difference is significant at $p < 0.05$ level.

**Difference is highly significant at $p < 0.001$ level

n=16 each: sixteen children per age group.

n in the approximant and approximant + trill column: number of target items for approximant and approximant + trill.

6.2.1.2 Consonant clusters

There are no consonant clusters in Mandarin and Malay. For consonant clusters in English, there was an obvious improvement with age in production accuracy (see Table 6.7). Statistical analysis confirmed that there was a significant age effect on consonant cluster production accuracy in English (*Kruskal-Wallis' $\chi^2 = 17.068$, $df = 3$, $p = 0.001$*).

Table 6.7: Consonant cluster production accuracy (mean percent correct & standard deviation) by age in English

Age group Cons. cluster	2;06-2;11 (n=16)	3;00-3;05 (n=16)	3;06-3;11 (n=16)	4;00-4;05 (n=16)	Whole group (n=64)
English (n=19)	47.70 (29.80)	51.97 (21.48)	75.00 (29.37)	79.61 (21.73)	63.56 (28.90)

n=16: sixteen children per age group.

n=19: number of target items for English consonant cluster.

Post-hoc analysis (see Table 6.8) showed that there was a significant improvement with age in consonant cluster production accuracy when comparing all age groups except for 2;06 vs. 3;00 and 3;06 vs. 4;00. These results suggest that the most significant changes may happen after age 3;00. This confirmed that there were age-related changes in consonant cluster production accuracy between 3;00 and 4;00 in English. Hence, it can be concluded that as with singleton consonant acquisition, there was a general developmental trend in the acquisition of consonant clusters in English.

Table 6.8: Age-related changes on consonant cluster production accuracy in English

Comparison of two age groups (n=16 each)	English consonant cluster (n=19)
2;06 vs. 3;00	0.926
3;00 vs. 3;06	0.011*
3;06 vs. 4;00	0.867
2;06 vs. 3;06	0.003*
3;00 vs. 4;00	0.002*
2;06 vs. 4;00	0.001*

**Difference is significant at $p < 0.05$ level.*

n=16 each: sixteen children per age group.

n=19: number of target items for English consonant cluster.

6.2.2 Vowels

As with consonants, children's vowel production was scored against adult pronunciation targets based on a "correct" or "wrong" criterion (see Chapter 5). Every child's vowel production accuracy was measured by percent correct converting from the raw score (see Chapter 5) using the formula below (Shriberg & Kwiatkowski, 1982):

$$\frac{\text{Total number of vowels produced correctly}}{\text{Total number of vowels tested}} \times 100\%$$

Mean percent correct and standard deviation for each age group for vowel production accuracy were calculated to determine if there was an age effect on children's vowel acquisition.

Table 6.9 shows that mean percent correct for vowels was generally higher but standard deviation was generally lower when compared to consonants (c.f. Table 6.1):

Table 6.9: Vowel production accuracy (mean percent correct & standard deviation) by age in English, Mandarin and Malay

Age grp \ Vowel	2;06-2;11 (n=16)	3;00-3;05 (n=16)	3;06-3;11 (n=16)	4;00-4;05 (n=16)	Whole group (n=64)
English (n=79)	96.99 (2.48)	98.34 (1.65)	97.47 (2.22)	98.02 (2.53)	97.70 (2.25)
Mandarin (n=57)	96.60 (4.60)	99.12 (2.22)	98.68 (3.48)	98.68 (3.30)	98.27 (3.55)
Malay (n=48)	97.92 (2.15)	99.22 (1.68)	97.01 (4.16)	98.57 (2.25)	98.17 (2.79)

*n=16: sixteen children per age group.
n in the vowel column: number of target items for vowel.*

Table 6.9 shows that there may be slight improvements with age in vowel production accuracy in all three languages. Statistical analysis confirmed that there were no significant age effects in English and Malay (*Kruskal-Wallis' chi*²*=3.768, df=3, p=0.288 for English; chi*²*=5.464, df=3, p=0.141 for Malay*), but there was a significant age effect on vowel production accuracy in Mandarin (*chi*²*=8.080, df=3, p=0.044*). Hence, it can be concluded that there was no

significant developmental trend in the acquisition of vowels in English and Malay. In Mandarin however, there was evidence of a developmental trend in the acquisition of vowels. This pattern of results for vowels may be attributed to ceiling effects: even the youngest children scored over 96.00% production accuracy in all three languages.

Post-hoc analysis (see Table 6.10) showed that in Mandarin, significant positive age effects on vowel production accuracy were found only when comparing the youngest age group with older age groups namely: 2;06 vs. 3;00 and 2;06 vs. 4;00 but not 2;06 vs. 3;06. This suggests that the most important developments in Mandarin vowel production accuracy occurred in the early part of the age range studied here.

Table 6.10: Age-related changes on vowel production accuracy in Mandarin

Comparison of two age groups (n=16 each)	Mandarin vowel (n=57)
2;06 vs. 3;00	0.047*
3;00 vs. 3;06	0.780
3;06 vs. 4;00	0.616
2;06 vs. 3;06	0.086
3;00 vs. 4;00	0.867
2;06 vs. 4;00	0.047*

**Difference is significant at $p < 0.05$ level.*

n=16 each: sixteen children per age group.

n=57: number of target items for Mandarin vowel.

Sub-types of vowels, namely monophthongs, diphthongs and triphthongs were tested in all three languages (see Table 6.11). The relatively low mean score for Mandarin triphthong production accuracy (i.e. 85.00) by the youngest 2;06-2;11 age group is presumably the cause of the patterns of age effects in vowel production accuracy in Mandarin.

Table 6.11: Production accuracy of vowel sub-types (mean percent correct & standard deviation) by age in English, Mandarin and Malay

Vowel	Age group	2;06-2;11 (n=16)	3;00-3;05 (n=16)	(n=16) (n=16)	4;00-4;05 (n=16)	Whole group (n=64)
	Language					
Monoph.	English (n=71)	97.10 (2.33)	98.15 (1.83)	97.27 (2.33)	97.89 (2.72)	97.60 (2.30)
	Mandarin (n=27)	96.99 (6.08)	98.61 (4.66)	98.38 (5.57)	97.45 (6.99)	97.85 (5.78)
	Malay (n=47)	97.87 (2.20)	99.20 (1.72)	96.94 (4.25)	98.54 (2.29)	97.60 (2.84)
Diph.	English (n=8)	96.09 (7.53)	100.00 (.00)	99.22 (3.13)	99.22 (3.13)	98.63 (4.51)
+ Vowel sequence	Mandarin (n=25)	98.50 (2.48)	100.00 (.00)	98.75 (2.41)	99.75 (1.00)	99.25 (1.86)
	Malay (n=1)	100.00 (.00)	100.00 (.00)	100.0 (.00)	100.00 (.00)	100.00 (.00)
Triph.	English	N/A				
	Mandarin (n=5)	85.00 (23.66)	97.50 (6.83)	100.0 (.00)	100.0 (.00)	99.74 (.77)
	Malay	N/A				

Diph.: diphthong.

Triph.: triphthong.

N/A: not available.

n=16: sixteen children per age group.

n next to the vowel sub-types column: number of target items for monophthong, diphthong plus vowel sequence, and triphthong.

6.2.3 Syllable structures

As with consonant and vowel production accuracy, children's syllable structures were scored against adult syllable structure based on a "correct" or "wrong" criterion (see Chapter 5). Every child's syllable structure accuracy was measured by percent correct converting from the raw score in each language (see Chapter 5), using the formula below:

$$\frac{\text{Total number of syllable structures produced correctly}}{\text{Total number of syllable structures tested}} \times 100\%$$

Mean percent correct for each age group for syllable structure accuracy was calculated to determine if there was an age effect on children's syllable structure acquisition.

Syllable structure accuracy for consonant clusters in English was excluded here in order to facilitate comparison of syllable structure acquisition across all three languages. Syllable structure of consonant clusters will be analysed qualitatively, in terms of error patterns, in Chapter 7.

Age effects

Mean percent correct and standard deviation for each age group for syllable structure accuracy is presented in Table 6.12:

Table 6.12: Syllable structure accuracy (mean percent correct & standard deviation) by age in English, Mandarin and Malay

Age grp Syl. structure	2;06-2;11 (n=16)	3;00-3;05 (n=16)	3;06-3;11 (n=16)	4;00-4;05 (n=16)	Whole group (n=64)
English (n= 37)	87.33 (7.63)	90.37 (7.18)	89.86 (9.94)	93.58 (5.91)	90.28 (7.93)
Mandarin (n= 38)	91.28 (12.07)	98.52 (2.54)	97.86 (5.94)	99.18 (2.67)	96.71 (7.51)
Malay (n= 26)	89.90 (11.14)	96.39 (4.54)	94.47 (12.32)	96.88 (3.50)	94.41 (9.01)

Age grp.: age group.

Syl. structure: syllable structure.

n=16: sixteen children per age group.

n in the syl. structure column: number of target items for syllable structure.

Table 6.12 shows that for syllable structure accuracy, there appears to be an improvement with age albeit with a plateau in the 3;06 age group in all three languages. Statistical analysis confirmed that there were significant age effects for syllable structure accuracy in English and Mandarin but not Malay (*Kruskal-Wallis' $\chi^2=9.933$, $df=3$, $p=0.019$ for English; $\chi^2=13.762$, $df=3$, $p=0.003$ for Mandarin; $\chi^2=6.240$, $df=3$, $p=0.100$ for Malay).*

Post-hoc analysis (see Table 6.13) showed that in English, there were significant age improvements in syllable structure accuracy when comparing the younger age group with the older age groups of at least 12 month-interval namely: 2;06 vs. 4;00 and 3;00 vs. 4;00 but not 2;06 vs. 3;06. This presumably was due to a plateau in the development of syllable structure accuracy in the 3;06 age group, which has resulted in no significant age improvement when comparing 3;06 age group with the youngest 2;06 age group. As for Mandarin, significant age improvements in syllable structure accuracy were found only when comparing the youngest age group with the older age groups namely: 2;06 vs. 3;00, 2;06 vs. 3;06 and 2;06 vs. 4;00. These results suggest the main improvements in syllable structure may occur slightly earlier in Mandarin than in English. Hence, it can be concluded that there was a significant developmental trend in the acquisition of syllable structures in English and Mandarin. In English however, there seems to be a plateau in the development of syllable structure from 3;06-3;11.

Table 6.13: Age-related changes on syllable structure accuracy in English and Mandarin

Comparison of two age groups (n=16 each)	English syllable structure (n=37)	Mandarin syllable structure (n=38)
2;06 vs. 3;00	0.270	0.026*
3;00 vs. 3;06	0.564	0.780
3;06 vs. 4;00	0.171	0.564
2;06 vs. 3;06	0.138	0.019*
3;00 vs. 4;00	0.035*	0.402
2;06 vs. 4;00	0.002*	0.004*

**Difference is significant at $p<0.05$ level.*

n=16 each: sixteen children per age group.

n in the syllable structure column: number of target items for syllable structure.

Mean scores for accuracy of syllable structure in words of different length are presented in Table 6.14:

Table 6.14: Syllable structure accuracy (mean percent correct & standard deviation) by age in English, Mandarin and Malay, for words of different length

Syl. struc.	Age grp	2;06-2;11 (n=16)	3;00-3;05 (n=16)	3;06-3;11 (n=16)	4;00-4;05 (n=16)	Whole group (n=64)
	Lang.					
Mono-	English (n=22)	86.93 (8.44)	88.64 (8.94)	87.78 (13.35)	92.90 (6.42)	89.06 (9.67)
	Mandarin (n=20)	95.31 (10.72)	99.38 (1.71)	98.13 (6.29)	99.69 (1.25)	98.12 (6.39)
	Malay (n=3)	93.75 (13.44)	95.83 (11.39)	95.83 (11.39)	97.92 (8.33)	95.83 (11.11)
Di-	English (n=13)	88.94 (11.91)	94.71 (5.42)	94.23 (9.53)	96.63 (4.84)	93.62 (8.72)
	Mandarin (n=17)	87.50 (14.71)	97.43 (5.25)	97.43 (6.06)	98.53 (4.56)	95.22 (9.59)
	Malay (n=26)	89.40 (11.44)	96.47 (4.55)	94.29 (12.77)	96.74 (4.05)	94.22 (9.36)
Tri.	English (n=2)	81.25 (25.00)	81.25 (25.00)	84.38 (23.94)	81.25 (30.96)	82.03 (25.76)
	Mandarin (n=1)	75.00 (44.72)	100.0 (0.00)	100.0 (0.00)	100.0 (0.00)	93.75 (24.39)
	Malay	N/A				

Syl. struc.: syllable structure.

Lang.: language.

Mono-: monosyllable.

Di-: disyllable.

Tri-: trisyllable.

N/A: not available.

n=16: sixteen children per age group.

n next to the syl. structure for words of different length: number of target items for monophthong, diphthong and triphthong.

Further to Table 6.14, statistical analysis was carried out to investigate the age effects for both monosyllable syllable structure accuracy and disyllable structure accuracy in English and Mandarin. Table 6.14 suggests that there may be improvements with age in both monosyllable and disyllable structure accuracy in English and Mandarin. However, statistical analysis confirmed that there were no significant age effects on monosyllable structure accuracy in both English and Mandarin (*Kruskal-Wallis' $\chi^2=7.136$, $df=3$, $p=0.068$ for English; $\chi^2=4.444$, $df=3$, $p=0.217$ for Mandarin). There were no significant age effects on disyllable structure accuracy in English as well (*Kruskal-Wallis' $\chi^2=6.447$, $df=3$, $p=0.092$), but there was a significant age effect on disyllable structure accuracy in Mandarin (*Kruskal-Wallis' $\chi^2=14.522$, $df=3$, $p=0.002$). Hence, it can be concluded that there were no significant developmental trend in the acquisition of monosyllable structure in both English and Mandarin. However, there was a general developmental trend in the acquisition of disyllable structure in Mandarin, but not English.***

Post-hoc analysis (see Table 6.15) showed that there were significant improvements in Mandarin disyllable structure accuracy, when comparing the youngest age-group with all other older age groups: 2;06 vs. 3;00; 2;06 vs. 3;06 and 2;06 vs. 4;00. This suggests that most important changes take place in the early part of the age range.

Table 6.15: Age-related changes on disyllable structure accuracy in Mandarin

Comparison of two age groups (n=16 each)	Mandarin disyllable structure (n=17)
2;06 vs. 3;00	0.012*
3;00 vs. 3;06	0.960
3;06 vs. 4;00	0.390
2;06 vs. 3;06	0.007*
3;00 vs. 4;00	0.390
2;06 vs. 4;00	0.002*

n=16 each: sixteen children per age group.

n=17: number of target items for Mandarin disyllable structure.

6.2.4 Tones

It was hypothesised that there would not a significant age effect for production accuracy of Mandarin tone, because previous monolingual and bilingual studies have indicated that tone is acquired early, before the youngest age considered in the present study (see Chapter 2). However, it is theoretically possible the tonal acquisition will be later among multilingual children, given the additional possibilities for interference and transfer across the three languages.

As with consonants, vowels and syllable structures, children’s tone production in Mandarin was scored against adult tone production based on a “correct” or “wrong” criterion. Every child’s tone production accuracy was measured by percent correct converting from raw score (a maximum of 56 since they were 56 test items)(see Chapter 5) using the formula below:

$$\frac{\text{Total number of tones produced correctly}}{56} \times 100\%$$

Mean percent correct for each age group for tone production accuracy was calculated to determine if there was an age effect on children’s tone acquisition.

Age effects

Mean percent correct and standard deviation for each age group for tone production accuracy is presented in Table 6.16:

Table 6.16: Tone production accuracy (mean percent correct & standard deviation) by age in Mandarin

Age grp Tone	2;06-2;11 (n=16)	3;00-3;05 (n=16)	3;06-3;11 (n=16)	4;00-4;05 (n=16)	Whole group (n=64)
Mandarin (n=56)	99.55 (1.03)	99.67 (0.97)	99.89 (0.45)	99.89 (0.45)	99.74 (0.77)

n=16: sixteen children per age group.

n=56: number of target items for Mandarin tone.

Table 6.16 shows that tone production accuracy for all age groups were high, with mean percent correct approaching 100.00. Statistical analysis confirmed that there was no significant age effect on tone production accuracy in Mandarin (*Kruskal-Wallis' chi*²*=1.833, df=3, p=0.608*). Hence, it can be concluded that there was no significant developmental trend in the acquisition of tones in Mandarin. Tones were acquired by 2;06-2;11.

6.3 CONSISTENCY OF WORD PRODUCTION

Children's consistency of word production was measured over two trials on five target words in each language. Consistency was scored according to whether the tokens of the target word were produced consistently in terms of consonants, vowels and syllable structures, irrespective of whether they matched the adult targets. For example, [zu-zu], [su-su], [zul-zul] (ZOO) were all scored as "consistent", whereas [zu-su], [zul-zu], [su-zul] (ZOO) were all scored as "inconsistent" (see Chapter 5). Consistency of word production was measured as "percent consistent" converting from raw score (a maximum of 5 since there were just five test items) using the formula below (c.f. Dodd, 1995b)(see Chapter 5):

$$\frac{\text{Total number of words produced consistently} \times 100\%}{5}$$

Mean percent consistent and standard deviation for each age group for consistency of word production was calculated to determine if there was an age effect on children's consistency of word production.

Age effects

Mean percent consistent and standard deviation for each age group for consistency of word production is presented in Table 6.17:

Table 6.17: Consistency of word production (mean percent correct & standard deviation) by age in English, Mandarin and Malay

Age grp Cons. of word prod.	2;06-2;11 (n=16)	3;00-3;05 (n=16)	3;06-3;11 (n=16)	4;00-4;05 (n=16)	Whole group (n=64)
English (n=5)	72.50 (17.70)	81.25 (15.44)	82.50 (20.49)	88.75 (14.55)	81.25 (17.77)
Mandarin (n=5)	88.75 (16.28)	93.75 (14.08)	92.50 (10.00)	98.75 (5.00)	93.43 (12.37)
Malay (n=5)	80.00 (17.89)	91.25 (12.58)	87.50 (14.38)	92.50 (10.00)	87.81 (14.52)

Consis. of word prod.: consistency of word production.

n=16: sixteen children per age group.

n=5: number of target items for consistency of word production.

Table 6.17 shows that overall there appears to be a trend towards increased consistency of word production with age in all three languages. Statistical analysis however confirmed that there were no significant age effects on consistency of word production in all three languages (*Kruskal-Wallis' $\chi^2=7.108$, $df=3$, $p=0.069$ for English; $\chi^2=5.661$, $df=3$, $p=0.129$ for Mandarin; $\chi^2=5.905$, $df=3$, $p=0.116$ for Malay).*

However, when consistency of correct production of target words alone (e.g. [bənɑnɑ-bənɑnɑ] for BANANA) (see Table 6.18) was considered, statistically significant age effects were found in all three languages (*Kruskal-Wallis' $\chi^2=13.498$, $df=3$, $p=0.004$ for English; $\chi^2=12.470$, $df=3$, $p=0.006$ for Mandarin; $\chi^2=9.558$, $df=3$, $p=0.023$ for Malay).*

Table 6.18: Sub-types of consistency of word production (mean percent correct & standard deviation) by age in English, Mandarin and Malay

Age group	2;06-2;11 (n=16)	3;00-3;05 (n=16)	3;06-3;11 (n=16)	4;00-4;05 (n=16)	Whole group (n=64)
Consistency of word prod.					
English (n=5)					
Consistently correct	35.00 (5.32)	45.00 (4.28)	60.00 (6.83)	65.00 (6.19)	51.25 (25.42)
Consistently wrong	37.50 (5.12)	36.25 (3.75)	22.50 (6.55)	23.75 (5.23)	30.00 (21.68)
Consistency total	72.50 (4.43)	81.25 (3.86)	82.50 (5.12)	88.75 (3.64)	81.25 (17.77)
Mandarin (n=5)					
Consistently correct	53.75 (7.24)	70.00 (6.32)	70.00 (7.75)	87.50 (6.29)	70.31 (29.60)
Consistently wrong	35.00 (5.32)	23.75 (6.88)	22.50 (6.80)	11.25 (6.05)	23.13 (26.00)
Consistency total	88.75 (4.07)	93.75 (3.52)	92.50 (2.50)	98.75 (1.25)	93.44 (12.37)
Malay (n=5)					
Consistently correct	50.00 (5.48)	58.75 (4.27)	61.25 (5.91)	72.50 (4.79)	60.63 (21.67)
Consistently wrong	30.00 (4.47)	32.50 (4.79)	26.25 (4.73)	18.75 (3.86)	26.88 (18.25)
Consistency total	80.00 (4.47)	91.25 (3.15)	87.50 (3.59)	91.25 (3.15)	87.81 (14.52)

n=16: sixteen children per age group.

n=5: number of target items for consistency of word production.

Table 6.18 shows that consistency of correct production of target words appears to increase with age, whilst consistency of wrong production of target words (e.g. [wɛn-wɛn] for VAN) appears to decrease with age.

Post-hoc analysis (see Table 6.19) confirmed that there were significant age improvements in consistency of correct word production when comparing the younger age groups with the older age groups of at least 12 month-interval namely: 2;06 vs. 4;00 and 3;00 vs. 4;00 in all three languages. In English, a significant age improvement was also found when comparing 2;06 vs. 3;06. Hence, it can be concluded that when consistency of wrong production of target words was disregarded (see Table 6.18), there was a significant developmental trend in consistency of word production in English, Mandarin and Malay.

Table 6.19: Age-related changes on consistency of correct word production in English, Mandarin and Malay

Comparison of two age groups (n=16 each)	English (n=5)	Mandarin (n=5)	Malay (n=5)
2;06 vs. 3;00	0.149	0.119	0.270
3;00 vs. 3;06	0.102	0.838	0.642
3;06 vs. 4;00	0.642	0.051	0.128
2;06 vs. 3;06	0.012*	0.110	0.196
3;00 vs. 4;00	0.023*	0.029*	0.023*
2;06 vs. 4;00	0.002*	0.001*	0.007*

**Difference is significant at $p < 0.05$ level.*

n=16 each: sixteen children per age group.

n=5: number of target items for consistency of word production.

6.4 CROSS-LINGUISTIC RELATIONSHIPS OF ACCURACY AND CONSISTENCY

In this section and the subsequent section 6.5, Pearson's partial correlation coefficients controlling for chronological age were used to investigate whether a child who was doing well in one language was also doing well in the other two languages. More specifically, it is aimed to find out whether a child who is doing well on one or more phonological aspects in one language is also doing well on the same aspects in the other two languages, for example, whether a child who is doing well on English plosives, fricatives, affricates etc. is also doing well on Mandarin and Malay plosives, fricatives, affricates etc. This is because in the present study, it is assumed that the multilingual children are drawn from a rather stable sociolinguistic group or community (see Chapter 1), receiving a roughly similar proportion of input exposure in the three languages. Though they receive least absolute input exposure to Malay, the relative amount of input exposure to the three languages is assumed to be generally the same. If this is the case, one would expect that the children who perform well in one language will also perform well in the other two languages (and vice versa). This would be manifested by a positive correlation in their performance across the three languages. Owing to the fact that the distribution of the main study test data on most variables was not normal (i.e. outliers plus distribution were negatively skewed on some variables), the data were normalized using Blom's proportion estimation formula for all partial correlations.

6.4.1 Singleton consonants

The results of the partial correlation of consonant production accuracy across the three languages, controlling for chronological age, are presented in Table 6.20:

Table 6.20: Cross-linguistic correlation of singleton consonant scores, controlling for chronological age

English vs. Mandarin	English vs. Malay	Mandarin vs. Malay
n=64, r=0.539, p=0.000**	n=64, r=0.571, p=0.000**	n=64, r=0.485, p=0.000**

*Correlation is significant at $p < 0.05$ level.

**Correlation is highly significant at $p < 0.001$ level

n=64: number of children tested.

Table 6.20 shows that highly significant relationships were found when comparing consonant production accuracy among the three languages namely: English vs. Mandarin, English vs. Malay, and Mandarin vs. Malay. This indicates that an individual child who was doing well in consonant production on one language showed a tendency to do well on the other two languages as well. This tendency also was evident for different manners of articulation presented in Table 6.21:

Table 6.21: Cross-linguistic correlation of consonant manner of articulation scores, controlling for chronological age

Consonant man. of articulation	English vs. Mandarin	English vs. Malay	Mandarin vs. Malay
Plosive (n=64)	r=0.434, p=0.000**	r=0.251, p=0.047*	r=0.285, p=0.023*
Fricative (n=64)	r=0.490, p=0.000**	r=0.558, p=0.000**	r=0.628, p=0.000**
Affricate (n=64)	r=0.483, p=0.000**	r=0.302, p=0.016*	r=0.349, p=0.005*
Nasal (n=64)	r=0.429, p=0.000**	r=0.348, p=0.005*	r=0.578, p=0.000**
Lateral (n=64)	r=0.551, p=0.000**	r=0.330, p=0.008*	r=0.400, p=0.001*
Approximant + trill (n=64)	r=0.338, p=0.007*	r=0.406, p=0.001*	r=0.360, p=0.004*

*Correlation is significant at $p < 0.05$ level.

**Correlation is highly significant at $p < 0.001$ level

n=64: number of children tested.

Table 6.21 shows that significant relationships were found when comparing the accuracy of all seven consonant manners of articulation across the three languages. Highly significant relationships were present for six out of the seven manner of articulation accuracy when comparing English and Mandarin. A highly significant relationship was also found for fricative manner of articulation accuracy when comparing all three languages. The weakly significant relationships present on some of the manner classes were presumably due to the low number of tokens tested (see Table 6.3 in section 6.2.1). Hence, it can be concluded that for consonant manner of articulation accuracy, an individual child who was doing well on one language was likely to do well on the other two languages as well. This tendency was particularly strong when comparing performance in English and Mandarin.

6.4.2 Vowels

The results for partial correlation of vowel production accuracy controlling for chronological age are presented in Table 6.22:

Table 6.22: Cross-linguistic correlation of vowel scores, controlling for chronological age

English vs. Mandarin	English vs. Malay	Mandarin vs. Malay
n=64, r=0.413, p=0.001*	n=64, r=0.381, p=0.002*	n=64, r=0.293, p=0.020*

**Correlation is significant at $p < 0.05$ level.
n=64: number of children tested.*

Table 6.22 shows that significant relationships were found when comparing vowel production accuracy across the three languages. This indicates that an individual child who was doing well on vowel production in one language showed a tendency to do well in the other two languages as well.

Table 6.23 shows that this tendency is evident for both monophthongs and diphthongs. Triphthongs were excluded here as they were only tested in Mandarin. Diphthongs were not tested in Malay.

Table 6.23: Cross-linguistic correlation of monophthong and diphthong scores, controlling for chronological age

Vowel type	English vs. Mandarin	English vs. Malay	Mandarin vs. Malay
Monophthong (n=64)	r=0.337, p=0.007*	r=0.340, p=0.006*	r=0.301, p=0.016*
Diphthong (n=64)	r=0.303, p=0.016*	N/A	N/A

N/A: not available.

**Correlation is significant at $p < 0.05$ level.*

n=64: number of children tested.

Table 6.23 shows that significant relationships were found when comparing monophthongs across the three languages. Likewise, a significant relationship was also found when comparing diphthongs in English and Mandarin. Hence, it can be concluded that as with consonants, for vowels, generally an individual child who was doing well in one language was likely to do well in the other two languages as well.

6.4.3 Syllable structures

The results of partial correlations for syllable structure accuracy across the three languages, controlling for chronological age, are presented in Table 6.24.

Table 6.24: Cross-linguistic correlation of syllable structure scores, controlling for chronological age

English vs. Mandarin	English vs. Malay	Mandarin vs. Malay
n=64, r=0.377, p=0.002*	n=64, r=0.337, p=0.007*	n=64, r=0.585, p=0.000**

**Correlation is significant at $p < 0.05$ level.*

***Correlation is highly significant at $p < 0.001$ level.*

n=64: number of children tested.

Table 6.24 shows that significant relationships were found when comparing syllable structure accuracy across the three languages. A highly significant relationship was found when comparing Mandarin and Malay. This indicates that an individual child who was doing well in syllable structure on one language was likely to do well on the other two languages as well. This tendency is evident for words of different length (see Table 6.25). Trisyllabic structures were not tested in Malay.

Table 6.25: Cross-linguistic correlation of syllable structure scores for mono-, di- and trisyllabic targets, controlling for chronological age

Syllable struc.	English vs. Mandarin	English vs. Malay	Mandarin vs. Malay
Monosyllable (n=64)	r=0.318, p=0.011*	r=0.252, p=0.047*	r=0.408, p=0.001*
Disyllable (n=64)	r=0.451, p=0.000**	r=0.308, p=0.014*	r=0.605, p=0.000**
Trisyllable (n=64)	r=-0.73, p=0.571	N/A	N/A

N/A: not available.

**Correlation is significant at $p < 0.05$ level.*

***Correlation is highly significant at $p < 0.001$ level.*

n=64: number of children tested.

Table 6.25 shows that significant relationships were found when comparing both monosyllable structures and disyllable structures across the three languages. Disyllable structures generally showed a stronger relationship than monosyllable structures. There was no significant relationship when comparing trisyllable structures in English and Mandarin. The absence of a significant relationship when comparing trisyllable structures in English and Mandarin may be due to the fact that trisyllable structures were tested in a low number of tokens in both languages. Hence, it can be concluded that for both monosyllable structures and disyllable structures, a child who was doing well in one language was likely to do well in the other two languages too. This tendency was slightly stronger in disyllable structures than in monosyllable structures. This relationship was not evident for trisyllable structures.

6.4.4 Consistency of word production

The results of partial correlations for consistency of word production are presented in Table 6.26:

Table 6.26: Cross-linguistic correlation of consistency scores, controlling for chronological age

English vs. Mandarin	English vs. Malay	Mandarin vs. Malay
n=64, r=0.200, p=0.116	n=64, r=0.079, p=0.537	n=64, r=0.134, p=0.293

Table 6.26 shows that no significant relationships were found when comparing consistency of word production across the three languages, when both correct and wrong productions were included. Table 6.27 shows that no significant relationships were found when comparing consistently wrong production of target words among the three languages. However, significant relationships were found

when comparing consistently correct production of target words in English vs. Mandarin and English vs. Malay. Hence, it can be concluded that for consistency of correct production of target words, an individual child who was doing well in English was likely to do well in the other two languages as well. However, this tendency was not shared among the three languages when consistency of wrong production of target words was taken into account.

Table 6.27: Cross-linguistic correlation of consistently correct and consistently wrong scores, controlling for chronological age

Consistency of word production	English vs. Mandarin	English vs. Malay	Mandarin vs. Malay
Consistently correct (n=64)	r=0.270, p=0.032*	r=0.347, p=0.005*	r=0.191, p=0.133
Consistently wrong (n=64)	r=-0.009, p=0.941	r=0.135, p=0.290	r=0.208, p=0.103
Consistency total (n=64)	r=0.200, p=0.116	r=0.079, p=0.537	r=0.134, p=0.293

*Correlation is significant at $p < 0.05$ level.
n=64: number of children tested.

6.5 INTRA-LINGUISTIC RELATIONSHIPS OF ACCURACY AND CONSISTENCY

In this section, Pearson's partial correlation coefficients controlling for chronological age were used to investigate whether a child who was doing well on one sub-part of the test for a particular language was also doing well on the other sub-parts of the test for that language. This analysis aimed to establish the construct validity of the test. Future research is needed in order to address the issues of the content and concurrent validity of the test.

Table 6.28 below shows that highly significant relationships were found when comparing scores on the sub-parts of the test in each language ($p < 0.05$), except for consonants and vowels in the English test.

Table 6.28: Intra-linguistic correlation of consonant, vowel, syllable structure and consistency of word production scores in English, Mandarin and Malay, controlling for chronological age

			p=.062 r=.237									
				p=.000** r=.582								
					p=.001* r=.395							
						p=.043* r=.256						
							p=.000** r=.664					
								p=.041* r=.258				
									p=.000** r=.482			
										p=.006* r=.340		
											p=.001* r=0.409	
												p=.002* r=.382
C	C	C	Vowel	Vowel	Vowel	Syllable	Syllable	Syllable	Consist	Consist	Consist	Cluster
n=	n=	n=	n=64	n=64	n=64	n=64	n=64	n=64	n=64	n=64	n=64	n=64
64	64	64										

Highlighted in black: English, blue: Mandarin, red: Malay.

C: consonant.

Vow: vowel.

Syl: syllable structure.

Clust: cluster.

Csist/consist: consistency of word production.

**Correlation is significant at $p < 0.05$ level.*

***Correlation is highly significant at $p < 0.001$ level.*

n=64: number of children tested.

The matrix presented in Table 6.28 suggests that for each test, overall the sub-parts of the test, i.e. consonants, consonant clusters (English only), vowels, syllable structures and consistency of word production, tap into a common factor i.e. speech ability. Hence, it can be concluded that overall test validity is high.

6.6 CONCLUSION

In this section, the hypotheses set out at the beginning of the chapter are considered in the light of the results.

- 1a. It is hypothesised that there is a significant age effect in each language for production accuracy of the following:
 - i. consonants.
 - ii. vowels.
 - iii. syllable structures.

Hypotheses 1a(i)-(iii) are supported.

- b. It is hypothesised that there is no significant age effect for production accuracy of Mandarin tone.

Hypotheses 1b is supported.

2. It is hypothesised that there is a significant age effect in each language for consistency of word production.

Hypothesis 2 is partially supported. A significant age effect was found in each language when consistency of “correct” production of target words alone was considered. However when consistency of “wrong” production of target words was also considered, the age effect was not statistically significant.

3. It is hypothesised that there is a significant relationship among the three languages for production accuracy of the following:

- i. consonants.
- ii. vowels.
- iii. syllable structures.

Hypotheses 3(i)-(ii) are supported. Hypothesis 3(iii) is partially supported. Significant relationships were found when comparing both monosyllable structures and disyllable structures among the three languages. However a significant relationship was not found when comparing trisyllable structures in English and Mandarin.

4. It is hypothesized that there is a significant relationship among the three languages for consistency of word production.

Hypothesis 4 is partially supported. Significant relationships were found when comparing “consistently correct production” of target words in English and Mandarin plus English and Malay. However significant relationships were not found when comparing “consistently wrong production” of target words among the three languages.

The implications of these findings will be discussed in Chapter 9.